# PATENT ABSTRACTS OF JAPAN

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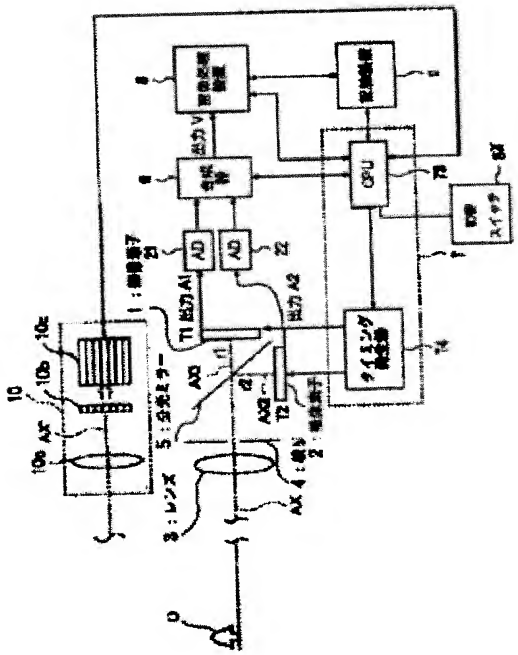
## (54) IMAGE FETCHING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To always provide a satisfactory image in spite of a difference in the luminance of an object.
SOLUTION: A controller 7 independently controls storage time T1 and T2 of imaging devices 1 and 2 through a timing generator 74 and can control the time into optimum values. The outputs of the imaging devices 1 and 2 are A/D converted for digital data processing and afterwards, the luminance is put together by a combiner 6. While an automatic mode is selected, the ratio of storage time between the imaging devices 1 and 2 is set so as to provide the combination image of suitable dynamic range corresponding to an object luminance range detected by a luminance range detecting part 10. While a manual mode is selected, on the other hand, the ratio of storage time between the imaging devices 1 and 2 is set so as to provide the combination image intended by a photographer corresponding the mode set, a wide dynamic range priority mode, a picture quality priority mode or an intermediate.



## CLAIMS

[Claim(s)]
[Claim 1]A division optical system which is arranged on an incident light axis from a photographic subject, and divides an optical path into a 2-way, The 1st and 2nd imaging means that while was divided by said division optical system and arranged on an optic axis of an optical path of another side an optic-axis top of an optical path, respectively, Automatic mode with which a device sets a dynamic range of a taken image as a predetermined range automatically, Manually, a photography person chooses one of the manual modes set as the range of desired, and it The 1st switchable selecting means, A photographic subject luminance range detection means to detect a photographic subject luminance range which is a luminance range of a photographic subject, An AD translation means which carries out the AD translation of each output of said 1st and 2nd imaging means, A synthesizing means which compounds and outputs an output after an AD translation of said 1st and 2nd imaging means, Storage time of picture information by said 1st imaging means, and storage time of picture information by said 2nd imaging means, An image taking device provided with a control means set up according to a photographic subject luminance range detected by said photographic subject luminance range detection means when automatic mode was chosen by said 1st selecting means.
[Claim 2]A division optical system which is arranged on an incident light axis from a photographic subject, and divides an optical path into a 2-way, The 1st and 2nd imaging means that while was divided by said division optical system and arranged on an optic axis of an optical path of another side an optic-axis top of an optical path, respectively, An adjustment device for a photography person to set a dynamic range of a taken image as the range of desired manually, An AD translation means which carries out the AD translation of each output of said 1st and 2nd imaging means, A synthesizing means which compounds and outputs an output after an AD translation of said 1st and 2nd imaging means, An image taking device provided with a control means which sets up storage time of picture information by said 1st imaging means, and storage time of picture information by said 2nd imaging means according to the range of said request set up by said adjustment device.
[Claim 3]When said automatic mode is chosen by said 1st selecting means, said control means, The image taking device according to claim 1 choosing a ratio (T1/T2) of the storage time T1 of said 1st imaging means, and the storage time T2 of said 2nd imaging means according to a photographic subject luminance range detected by said photographic subject luminance range detection means.
[Claim 4]The image taking device according to claim 1 provided with the 2nd selecting means that can change a size of a dynamic range selectively when a photography person sets a dynamic range of a taken image as the range of desired manually.
[Claim 5]When a photography person sets a dynamic range of a taken image as the range of desired manually, The image taking device according to claim 4 characterized by choosing a ratio (T1/T2) of the storage time T1 of said 1st imaging means, and the storage time T2 of said 2nd imaging means according to a size of a dynamic range with said 2nd selected selecting means.
[Claim 6]Have further the 3rd selecting means that chooses relative relation of timing of the storage time T1 of said 1st imaging means at the time of release operation, and the storage time

T2 of said 2nd imaging means, and said control means, At the time of release operation, Claim 1 controlling said 1st and 2nd imaging means according to timing with said 3rd selected selecting means and Claim 2 are the image taking devices of a description either.
[Claim 7]Said photographic subject luminance range detection means is realized by using said 1st and 2nd image sensors itself, The image taking device according to claim 1 changing said storage time T1 and T2, maintaining a ratio (T1/T2) of the storage time T1 of said 1st image sensor, and the storage time T2 of the 2nd image sensor beyond a predetermined value, and detecting a photographic subject luminance range.
[Claim 8]Said synthesizing means are luminosity areas of overlap with which luminosity of picture information which said 1st and 2nd imaging means output overlaps, The image taking device according to claim 1 characterized by a form or a parameter changing according to said photographic subject luminance range when it compounds using a weight function which changes continuously about luminosity and, as for the weight function concerned, said 1st selecting means has chosen said automatic mode.
[Claim 9]Said synthesizing means are luminosity areas of overlap with which luminosity of picture information which said 1st and 2nd imaging means output overlaps, Compound using a weight function which changes continuously about luminosity, and and the weight function concerned, Claim 1 when a photography person sets a dynamic range of a taken image as the range of desired manually, wherein a form or a parameter changes according to a size of the range of the set-up request concerned, and Claim 2 are the image taking devices of a description either.
[Claim 10]Have further a stroboscope, the 4th selecting means that chooses condition of use of a stroboscope, and a stroboscope attainment area identification means to detect and identify within a picture a field at which a stroboscope arrives, and said synthesizing means, By luminosity areas of overlap of picture information which said 1st and 2nd imaging means output, compound using a weight function which changes continuously about luminosity, and and the weight function concerned, According to a result identified by said stroboscope attainment area identification means, Claim 1, wherein a form or a parameter changes, and Claim 2 are the image taking devices of a description either.
[Claim 11]Have further a stroboscope and the 4th selecting means that chooses condition of use of a stroboscope, and said control means, At the time of stroboscope use, control the 1st and 2nd image sensors concerned so that storage time of said 1st image sensor and storage time of the 2nd image sensor become equal automatically, and said synthesizing means, Claim 1 compounding by adding in intensity picture information which said 1st and 2nd imaging means output, and Claim 2 are the image taking devices of a description either.
[Claim 12]As for said synthesizing means, Claim 1 performing a compositing process by software processing by a central processing unit which constitutes said control means, and Claim 2 are the image taking devices of a description either.
[Claim 13]The image taking device according to claim 1, wherein said 1st and 2nd imaging means are [ both ] color imaging means which can incorporate a full color image alone.
[Claim 14]The image taking device according to claim 2, wherein said 1st and 2nd imaging means are [ both ] color imaging means which can incorporate a full color image alone.
[Claim 15]Claim 13 although said color imaging means has an ontip color filter and a pixel is arranged relatively in the same space, wherein a color of an ontip color filter is arranged in spatial position relatively shifted, and Claim 14 are the image taking devices of a description either.
[Claim 16]The image taking device according to claim 1 changing an algorithm of composition by said synthesizing means by case where said photographic subject luminance range is narrower than a predetermined value, and a case where it is large when said 1st selecting means has chosen said automatic mode.
[Claim 17]In a case where said synthesizing means is set as the range of a photography person's request of a dynamic range of a taken image with hand control, The image taking device according to claim 4 characterized by changing an algorithm of composition by said synthesizing means according to a size of a dynamic range with said 2nd selected selecting means.
[Claim 18]In a case where said 1st and 2nd imaging means are [ both ] color imaging means

which can incorporate a full color image alone, and said 1st selecting means has chosen said automatic mode, When said photographic subject luminance range is narrow, said synthesizing means performs picture composition using an algorithm which gave priority to false color prevention and improvement in resolution, and when said photographic subject luminance range is wide, The image taking device according to claim 1, wherein said synthesizing means performs picture composition using an algorithm which gave priority to dynamic range expansion.
[Claim 19]In a case where said 1st and 2nd imaging means are [ both ] color imaging means which can incorporate a full color image alone, and a photography person sets a dynamic range of a taken image as the range of desired manually, When a narrow dynamic range is chosen by said 2nd selecting means, When said synthesizing means performs picture composition using an algorithm which gave priority to false color prevention and improvement in resolution and a large dynamic range is chosen by said 2nd selecting means, The image taking device according to claim 4, wherein said synthesizing means performs picture composition using an algorithm which gave priority to dynamic range expansion.

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[Translation done.]

## CLAIMS

[Claim(s)]
[Claim 1]A division optical system which is arranged on an incident light axis from a photographic subject, and divides an optical path into a 2-way, The 1st and 2nd imaging means that while was divided by said division optical system and arranged on an optic axis of an optical path of another side an optic-axis top of an optical path, respectively, Automatic mode with which a device sets a dynamic range of a taken image as a predetermined range automatically, Manually, a photography person chooses one of the manual modes set as the range of desired, and it The 1st switchable selecting means, A photographic subject luminance range detection means to detect a photographic subject luminance range which is a luminance range of a photographic subject, An AD translation means which carries out the AD translation of each output of said 1st and 2nd imaging means, A synthesizing means which compounds and outputs an output after an AD translation of said 1st and 2nd imaging means, Storage time of picture information by said 1st imaging means, and storage time of picture information by said 2nd imaging means, An image taking device provided with a control means set up according to a photographic subject luminance range detected by said photographic subject luminance range detection means when automatic mode was chosen by said 1st selecting means.
[Claim 2]A division optical system which is arranged on an incident light axis from a photographic subject, and divides an optical path into a 2-way, The 1st and 2nd imaging means that while was divided by said division optical system and arranged on an optic axis of an optical path of another side an optic-axis top of an optical path, respectively, An adjustment device for a photography person to set a dynamic range of a taken image as the range of desired manually, An AD translation means which carries out the AD translation of each output of said 1st and 2nd imaging means, A synthesizing means which compounds and outputs an output after an AD translation of said 1st and 2nd imaging means, An image taking device provided with a control means which sets up storage time of picture information by said 1st imaging means, and storage time of picture information by said 2nd imaging means according to the range of said request set up by said adjustment device.
[Claim 3]When said automatic mode is chosen by said 1st selecting means, said control means, The image taking device according to claim 1 choosing a ratio (T1/T2) of the storage time T1 of said 1st imaging means, and the storage time T2 of said 2nd imaging means according to a photographic subject luminance range detected by said photographic subject luminance range detection means.
[Claim 4]The image taking device according to claim 1 provided with the 2nd selecting means that can change a size of a dynamic range selectively when a photography person sets a dynamic range of a taken image as the range of desired manually.
[Claim 5]When a photography person sets a dynamic range of a taken image as the range of desired manually, The image taking device according to claim 4 characterized by choosing a ratio (T1/T2) of the storage time T1 of said 1st imaging means, and the storage time T2 of said 2nd imaging means according to a size of a dynamic range with said 2nd selected selecting means.
[Claim 6]Have further the 3rd selecting means that chooses relative relation of timing of the storage time T1 of said 1st imaging means at the time of release operation, and the storage time

T2 of said 2nd imaging means, and said control means, At the time of release operation, Claim 1 controlling said 1st and 2nd imaging means according to timing with said 3rd selected selecting means and Claim 2 are the image taking devices of a description either.
[Claim 7]Said photographic subject luminance range detection means is realized by using said 1st and 2nd image sensors itself, The image taking device according to claim 1 changing said storage time T1 and T2, maintaining a ratio (T1/T2) of the storage time T1 of said 1st image sensor, and the storage time T2 of the 2nd image sensor beyond a predetermined value, and detecting a photographic subject luminance range.
[Claim 8]Said synthesizing means are luminosity areas of overlap with which luminosity of picture information which said 1st and 2nd imaging means output overlaps, The image taking device according to claim 1 characterized by a form or a parameter changing according to said photographic subject luminance range when it compounds using a weight function which changes continuously about luminosity and, as for the weight function concerned, said 1st selecting means has chosen said automatic mode.
[Claim 9]Said synthesizing means are luminosity areas of overlap with which luminosity of picture information which said 1st and 2nd imaging means output overlaps, Compound using a weight function which changes continuously about luminosity, and and the weight function concerned, Claim 1 when a photography person sets a dynamic range of a taken image as the range of desired manually, wherein a form or a parameter changes according to a size of the range of the set-up request concerned, and Claim 2 are the image taking devices of a description either.
[Claim 10]Have further a stroboscope, the 4th selecting means that chooses condition of use of a stroboscope, and a stroboscope attainment area identification means to detect and identify within a picture a field at which a stroboscope arrives, and said synthesizing means, By luminosity areas of overlap of picture information which said 1st and 2nd imaging means output, compound using a weight function which changes continuously about luminosity, and and the weight function concerned, According to a result identified by said stroboscope attainment area identification means, Claim 1, wherein a form or a parameter changes, and Claim 2 are the image taking devices of a description either.
[Claim 11]Have further a stroboscope and the 4th selecting means that chooses condition of use of a stroboscope, and said control means, At the time of stroboscope use, control the 1st and 2nd image sensors concerned so that storage time of said 1st image sensor and storage time of the 2nd image sensor become equal automatically, and said synthesizing means, Claim 1 compounding by adding in intensity picture information which said 1st and 2nd imaging means output, and Claim 2 are the image taking devices of a description either.
[Claim 12]As for said synthesizing means, Claim 1 performing a compositing process by software processing by a central processing unit which constitutes said control means, and Claim 2 are the image taking devices of a description either.
[Claim 13]The image taking device according to claim 1, wherein said 1st and 2nd imaging means are [ both ] color imaging means which can incorporate a full color image alone.
[Claim 14]The image taking device according to claim 2, wherein said 1st and 2nd imaging means are [ both ] color imaging means which can incorporate a full color image alone.
[Claim 15]Claim 13 although said color imaging means has an ontip color filter and a pixel is arranged relatively in the same space, wherein a color of an ontip color filter is arranged in spatial position relatively shifted, and Claim 14 are the image taking devices of a description either.
[Claim 16]The image taking device according to claim 1 changing an algorithm of composition by said synthesizing means by case where said photographic subject luminance range is narrower than a predetermined value, and a case where it is large when said 1st selecting means has chosen said automatic mode.
[Claim 17]In a case where said synthesizing means is set as the range of a photography person's request of a dynamic range of a taken image with hand control, The image taking device according to claim 4 characterized by changing an algorithm of composition by said synthesizing means according to a size of a dynamic range with said 2nd selected selecting means.
[Claim 18]In a case where said 1st and 2nd imaging means are [ both ] color imaging means

which can incorporate a full color image alone, and said 1st selecting means has chosen said automatic mode, When said photographic subject luminance range is narrow, said synthesizing means performs picture composition using an algorithm which gave priority to false color prevention and improvement in resolution, and when said photographic subject luminance range is wide, The image taking device according to claim 1, wherein said synthesizing means performs picture composition using an algorithm which gave priority to dynamic range expansion.
[Claim 19]In a case where said 1st and 2nd imaging means are [ both ] color imaging means which can incorporate a full color image alone, and a photography person sets a dynamic range of a taken image as the range of desired manually, When a narrow dynamic range is chosen by said 2nd selecting means, When said synthesizing means performs picture composition using an algorithm which gave priority to false color prevention and improvement in resolution and a large dynamic range is chosen by said 2nd selecting means, The image taking device according to claim 4, wherein said synthesizing means performs picture composition using an algorithm which gave priority to dynamic range expansion.

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[Translation done.]

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the art of performing dynamic range expansion and image quality improvement of a digital still camera especially while reflecting a photography person's intention, about the image taking device for which a still picture etc. are incorporated as a digital signal.
[0002]
[Description of the Prior Art]The camera of a low price is realizable so that an image sensor is small, but each pixel size becomes small with increase of a pixel number, and the dynamic range of the image sensor which was liable to insufficient is in a still more insufficient tendency from the former.
[0003]The method of using two or more image pick-up results of having changed the light exposure, as the solution is known.
[0004]For example, in JP,8-223491,A, as shown in drawing 21, the output of the image sensor with little nothing and incident light quantity was amplified so that the incident light quantity to the two image sensors A and B might change with spectrum mirrors, and it compounded with the output of the image sensor with much incident light quantity, and expansion of a dynamic range is realized.
[0005]As an option, as shown in drawing 22, what captures an image continuously by different storage time is known using one image sensor CCD. If concrete operation is explained, an image will be first captured by long exposure time, and it will memorize in a memory temporarily. It compounds with the picture which captured the image by short exposure time continuously, was captured previously, and was memorized in the memory, and the composition which the dynamic range expanded is compounded. (an example -- ****** -- paper "dynamic range expansion method for vehicle loading" Institute of Electronics, Information and Communication Engineers paper magazine October, 1995 item pp.1439)
The principle of dynamic range expansion is shown in drawing 23. Two images which changed the light exposure to a certain photographic subject are captured. Although the picture with a larger light exposure is saturated with a high luminance part at this time, the picture with a smaller light exposure is not saturated yet, but it is saturated for the first time since luminosity becomes fairly high. After taking into consideration each light exposure difference of two sheets, by a low luminance part, a picture is combined using a picture with a small light exposure using a picture with a large light exposure by a high luminance part. As a result, the picture to which the dynamic range was expanded equivalent is acquired.
[0006]
[Problem(s) to be Solved by the Invention]The luminance difference of a photographic subject is various, even when it changes with scenes and differs also thousands times with the dynamic range of one image sensor from a covering ****** case (for example, about 400 or less times).
[0007]When the luminance difference of a photographic subject is small, the good picture in which a composite boundary is not [ the direction which the light exposure of the image sensor of a couple photoed in the range which seldom changes ] conspicuous can be combined. The

good picture it is [ a dynamic range ] larger to have changed the light exposure of the image sensor of a couple a lot, and to photo it on the other hand when the luminance difference of a photographic subject is large is compoundable.
[0008]However, in the conventional example shown in drawing 21, since the ratio of the light exposure of the image sensor of a couple is being fixed, the image of the photographic subject luminance range always fixed regardless of the luminance difference of a photographic subject is captured. Therefore, the good picture corresponding to change of the luminance difference of a photographic subject cannot be acquired.
[0009]In the conventional example shown in drawing 22, in order to capture an image continuously, when the object which moves is photoed, gap of a picture will arise in a high luminance part and a low luminance part.
[0010]Then, an object of this invention is to acquire an always good picture irrespective of the luminance difference of a photographic subject.
[0011]
[Means for Solving the Problem]In order to solve an aforementioned problem, an image taking device of this invention, A division optical system which is arranged on an incident light axis from a photographic subject, and divides an optical path into a 2-way, The 1st and 2nd imaging means that while was divided by said division optical system and arranged on an optic axis of an optical path of another side an optic-axis top of an optical path, respectively, Automatic mode with which a device sets a dynamic range of a taken image as a predetermined range automatically, Manually, a photography person chooses one of the manual modes set as the range of desired, and it The 1st switchable selecting means, A photographic subject luminance range detection means to detect a photographic subject luminance range which is a luminance range of a photographic subject, An AD translation means which carries out the AD translation of each output of said 1st and 2nd imaging means, A synthesizing means which compounds and outputs an output after an AD translation of said 1st and 2nd imaging means, Storage time of picture information by said 1st imaging means, and storage time of picture information by said 2nd imaging means, When automatic mode is chosen by said 1st selecting means, it has a control means set up according to a photographic subject luminance range detected by said photographic subject luminance range detection means. Thereby, in automatic mode which controls a dynamic range automatically, according to luminance difference of a photographic subject, storage time can be set up every 1st and 2nd imaging means, an image of a suitable dynamic range can be captured, and a good picture according to luminance difference of a photographic subject can be acquired.
[0012]A division optical system which another image taking device of this invention is arranged on an incident light axis from a photographic subject, and divides an optical path into a 2-way, The 1st and 2nd imaging means that while was divided by said division optical system and arranged on an optic axis of an optical path of another side an optic-axis top of an optical path, respectively, An adjustment device for a photography person to set a dynamic range of a taken image as the range of desired manually, An AD translation means which carries out the AD translation of each output of said 1st and 2nd imaging means, A synthesizing means which compounds and outputs an output after an AD translation of said 1st and 2nd imaging means, It has a control means which sets up storage time of picture information by said 1st imaging means, and storage time of picture information by said 2nd imaging means according to the range of said request set up by said adjustment device. Based on the range of a request set up by an adjustment device, storage time can be set up every 1st and 2nd imaging means by this, and an image which has a desired dynamic range can be captured.
[0013]When said automatic mode is chosen by said 1st selecting means according to the desirable mode, Said control means chooses a ratio (T1/T2) of the storage time T1 of said 1st imaging means, and the storage time T2 of said 2nd imaging means according to a photographic subject luminance range detected by said photographic subject luminance range detection means.
[0014]According to the desirable mode, when a photography person sets a dynamic range of a taken image as the range of desired manually, it has the 2nd selecting means that can change a

size of a dynamic range selectively.
[0015]When a photography person sets a dynamic range of a taken image as the range of desired manually according to the desirable mode, According to a size of a dynamic range with said 2nd selected selecting means, a ratio (T1/T2) of the storage time T1 of said 1st imaging means and the storage time T2 of said 2nd imaging means is chosen.
[0016]According to the desirable mode, it has further the 3rd selecting means that chooses relative relation of timing of the storage time T1 of said 1st imaging means at the time of release operation, and the storage time T2 of said 2nd imaging means, Said control means controls said 1st and 2nd imaging means according to timing with said 3rd selected selecting means at the time of release operation. A picture which made influence of Bure the minimum with a photographic subject with a motion by this, or a picture using Bure as an expressive medium can be acquired.
[0017]According to the desirable mode, said photographic subject luminance range detection means is realized by using said 1st and 2nd image sensors itself, Said storage time T1 and T2 are changed maintaining a ratio (T1/T2) of the storage time T1 of said 1st image sensor, and the storage time T2 of the 2nd image sensor beyond a predetermined value, and a photographic subject luminance range is detected. Thereby, structure of an image taking device can be made easy and economical.
[0018]By luminosity areas of overlap whose luminosity of picture information which said 1st and 2nd imaging means output [ said synthesizing means ] overlaps according to the desirable mode. When it compounds using a weight function which changes continuously about luminosity and said 1st selecting means has chosen said automatic mode in the weight function concerned, a form or a parameter changes according to said photographic subject luminance range. Discontinuity in a boundary at the time of this combining a picture which the 1st and 2nd imaging means output with automatic mode can be lessened.
[0019]By luminosity areas of overlap whose luminosity of picture information which said 1st and 2nd imaging means output [ said synthesizing means ] overlaps according to the desirable mode. When compounding using a weight function which changes continuously about luminosity and setting the weight function concerned as the range of a photography person's request of a dynamic range of a taken image with hand control, a form or a parameter changes according to a size of the range of the set-up request concerned. Discontinuity in a boundary at the time of combining a picture which sets up a dynamic range manually and the 1st and 2nd imaging means output by this can be lessened.
[0020]The 4th selecting means that chooses condition of use of a stroboscope and a stroboscope according to the desirable mode, Have further a stroboscope attainment area identification means to detect and identify within a picture a field at which a stroboscope arrives, and said synthesizing means, Compounding [ and ] using a weight function which changes continuously about luminosity by luminosity areas of overlap of picture information which said 1st and 2nd imaging means output, the weight function concerned changes a form or a parameter according to a result identified by said stroboscope attainment area identification means. Thereby, a large picture of a dynamic range can be acquired also at the time of stroboscope use.
[0021]According to the desirable mode, it has further a stroboscope and the 4th selecting means that chooses condition of use of a stroboscope, At the time of stroboscope use, said control means controls the 1st and 2nd image sensors concerned so that storage time of said 1st image sensor and storage time of the 2nd image sensor become equal automatically, Said synthesizing means compounds by adding in intensity picture information which said 1st and 2nd imaging means output. Thereby, a S/N ratio can be raised and image quality can be improved.
[0022]According to the desirable mode, said synthesizing means performs a compositing process by software processing by a central processing unit which constitutes said control means.
[0023]According to the desirable mode, it is characterized by being a color imaging means with said 1st and 2nd imaging means able to incorporate a full color image with both simple substances.
[0024]According to the desirable mode, said color imaging means has an ontip color filter, and a

pixel is arranged relatively in the same space, but a color of an ontip color filter is arranged in spatial position relatively shifted.
[0025]According to the desirable mode, when said 1st selecting means has chosen said automatic mode, an algorithm of composition by said synthesizing means is changed by case where said photographic subject luminance range is narrower than a predetermined value, and a case where it is large.
[0026]In a case where said synthesizing means sets a dynamic range of a taken image as the range of a photography person's request with hand control according to the desirable mode, According to a size of a dynamic range with said 2nd selected selecting means, an algorithm of composition by said synthesizing means is changed.
[0027]According to the desirable mode, said 1st and 2nd imaging means, When it is a color imaging means which can incorporate a full color image with both simple substances, said 1st selecting means has chosen said automatic mode and said photographic subject luminance range is narrow, Said synthesizing means performs picture composition using an algorithm which gave priority to false color prevention and improvement in resolution, and when said photographic subject luminance range is wide, said synthesizing means performs picture composition using an algorithm which gave priority to dynamic range expansion.
[0028]It is a color imaging means in which said 1st and 2nd imaging means are able to incorporate a full color image with both simple substances according to the desirable mode, When a photography person sets a dynamic range of a taken image as the range of desired manually and a narrow dynamic range is chosen by said 2nd selecting means, When said synthesizing means performs picture composition using an algorithm which gave priority to false color prevention and improvement in resolution and a large dynamic range is chosen by said 2nd selecting means, Said synthesizing means performs picture composition using an algorithm which gave priority to dynamic range expansion. Discontinuity in a boundary at the time of this combining a picture which the 1st and 2nd imaging means output can be lessened.
[0029]
[Explanation of the contents of the invention] Hereafter, a fundamental principle of this invention is explained briefly.
[0030]In an image taking device of this invention, a good picture according to luminance difference of a photographic subject and a picture of a request according to a photography person's intention can be acquired by using two imaging means (the 1st and 2nd image sensors), and making a ratio of those storage time variable.
[0031]In the range which prevents a light volume fall by dividing light into two image sensors and to which the storage time (exposure time) T1 of the 1st and 2nd image sensors and a difference of T2 do not become extremely large. It is preferred to make small light volume distribution to the 2nd image sensor (1/3 or less [ for example, ]), and to enlarge light volume distribution to the 1st image sensor (2/3 or more [ for example, ]). In this case, a ratio of light volume distribution in both more than doubles.
[0032]When automatic mode which controls an anticipated-use state, i.e., a dynamic range, automatically is chosen, According to photographic subject luminosity detected by a photographic subject luminance range detection means, a camera chooses a ratio (T1/T2) of optimal storage time automatically, and a picture with sufficient image quality to a narrow picture of a luminance range in a large picture of a dynamic range is photoed to a large picture of a luminance range.
[0033]In the above automatic modes, also when a photography person's intention cannot be reflected, for a certain reason, it uses that a manual mode which adjusts a dynamic range manually can also be set up. When such a manual mode is chosen, it enables it to choose an extensive dynamic range priority mode and ** dynamic range mode (image quality priority mode) further.
[0034]In an extensive dynamic range priority mode, by compounding picture information suitably, the large picture of a dynamic range is always acquired and a picture with little black crushing and white crushing can be acquired. On the other hand, although it becomes equivalent [ a dynamic range ] to the case of a single plate image sensor in image quality priority mode, a false

color can acquire few good pictures of resolving by compounding picture information suitably.
[0035]The example of the algorithm for compounding the picture information outputted to below from the 1st and 2nd image sensors is explained for reference.
[0036]If the output value corresponding to the pixel (x, y) of the picture picturized by the exposing condition Ei is set to Li (x, y) (here, it is i= 1 and 2), the picture Lwid (x, y) to which the dynamic range was expanded will be searched for as following.
for i=1 to i = 2 do for(x, y) =(0, 0) to (X−1, Y−1) do if i=1 then Lwid(x, y) =L1(x, y)(E2/E1) gamma else if L2(x, y)<Lsat. then Lwid(x,y)=L2(x,y)
E2/E1 is an exposure ratio of the 1st and 2nd image sensors, gamma is a parameter of gamma correction here, and Lsat is a saturation value of the output of the 2nd image sensor.
[0037]Next, the synthesizing method adapting another algorithm is explained. Discontinuity may arise in the boundary part of the field picturized according to a different exposure condition in the above−mentioned method. Therefore, in the overlapped range of luminosity, the method of compounding using the weight function which changes continuously to luminosity is taken. In this case, the picture Lwid (x, y) is searched for as following.
for. i=1 to i=2 do for(x, y) = (0, 0). to (X−1, Y−1) do if i= — 1 then Lwid(x, y) =L1(x, y)(E2/E1) gamma else Lwid(x, y) =f(L2 (x, y)) L2(x, y)(E2/E1) gamma+{1−f(L2 (x, y))} Lwidgamma −− here, f is a weight function when combining a picture.
[0038]
[Embodiment of the Invention][A 1st embodiment] Drawing 1 is a figure explaining the image taking device concerning a 1st embodiment. This image taking device is provided with the following.
The taking lens 3 for photoing the image of the photographic subject O.
The diaphragm 4 which is arranged just behind the taking lens 3 and adjusts light volume.
The part optical mirror 5 which is a division optical system which is arranged on the optic axis AX and divides an optical path into a 2−way.
The 1st image sensor 1 that while was divided by the spectrum mirror 5 and has been arranged on the optic axis AX1 by the side of light flux, The 2nd image sensor 2 arranged on the optic axis AX2 by the side of the light flux of divided another side, The output A1 of each image sensors 1 and 2, and AD converters 21 and 22 which carry out the AD translation of A2, respectively, The composing device 6 which compounds and outputs the output after the AD translation from AD converters 21 and 22, the control device 7 which controls operation of each image sensors 1 and 2 or the composing device 6, and the changeover switch SW which is the selecting means for setting up the operating state of the control device 7 by the photography person side.

[0039]This image taking device is further provided with the luminance range primary detecting element 10 which detects the photographic subject luminance range which is a luminance range of the photographic subject O apart from the optical system for photoing the image of the photographic subject O. This luminance range primary detecting element 10 has the following.
The 2nd lens 10a that carries out image formation of the image of the photographic subject O independently [ the taking lens 3 ].
Hyperfractionation SPD(silicon photo diode) 10b on which it is arranged on optic−axis AX' of the 2nd lens 10a almost parallel to the optic axis AX, and the image of the photographic subject O is projected.
log amplifier 10c connected in parallel with each element which constitutes this hyperfractionation SPD10b.
This is the same structure as the multi−photometry sensor for light exposure detection of a film−based camera, and a detection range is wide and can measure the luminance range of a photographic subject with light measurement once. Based on the output (namely, photographic subject luminance range) from this luminance range primary detecting element 10, the storage time (exposure time) and the ** value of the diaphragm 4 in each image sensors 1 and 2 can be determined, and it can use for setting out of a parameter required for the compositing process which can set the composing device 6 etc.
[0040]The control device 7 is provided with the following.

CPU73 which has work of controlling operation of an image taking device in generalization, and controlling operation of the composing device 6 based on the output of the luminance range primary detecting element 10, or setting out of the changeover switch SW (central processing unit).
The timing generator 74 which controls the storage time for the image pick-up by both the image sensors 1 and 2 according to the directions from this CPU73.

[0041]The output V which is the picture information after the composition outputted from the composing device 6 under control by the control device 7 is inputted into the image processing device 8, and various signal processing and compression processing are performed. The data after Image Processing Division from the image processing device 8 is inputted into the memory storage 9, and is saved here. The suitable composition for this, etc. are processed and it saves the acquired picture suitably while the control device 7 is controlling not only the composing device 6 but operation of the image processing device 8 and the memory storage 9 and makes a required image capture to the suitable timing for each image sensors 1 and 2 based on directions of release operation.
[0042]Drawing 2 is a figure explaining the example of the changeover switch SW. The changeover switch SW of a graphic display is for performing selection of by any to set up the dynamic range of a taken image between automatic mode or a manual mode, and selection of by any to take a photograph between extensive dynamic range priority or image quality priority in a manual mode. The former automatic mode is operational mode which sets the dynamic range of the taken image to adjust as the predetermined range automatically, and the latter manual mode is operational mode which a photography person sets as the range of desired manually.
[0043]Switch SW1 which is the 1st selecting means that chooses any drawing 2 (a) shall make a dynamic range between automatic mode or a manual mode, It is the example which provided independently switch SW2 which is the 2nd selecting means that chooses into extensive dynamic range priority, image quality priority, and those middle any photographing mode is made in a manual mode. Drawing 2 (b) is an example of switch SW12 which put together selection of any to use between automatic mode or a manual mode, and selection of into extensive dynamic range priority, image quality priority, and those middle any to make photographing mode in a manual mode. Drawing 2 (c), looking at the menu displayed on the screen of liquid crystal display LCD. It is an example which chooses selection of any to use between automatic mode or a manual mode, and selection of into extensive dynamic range priority, image quality priority, and those middle any to make photographing mode in a manual mode by command button SW3 of a couple.
[0044]When dynamic range automatic mode is set up by the changeover switch SW as shown in drawing 2, setting out of the change-over switch SW about a manual mode becomes invalid. If release of the image taking device is carried out where automatic mode is set up, According to the photographic subject luminance range detected by the luminance range primary detecting element 10 which shows drawing 1, a camera chooses the value and ratio (T1/T2) of the optimal storage time automatically, and a picture with the sufficient image quality to the narrow picture of a luminance range in the large picture of a dynamic range is photoed to the large picture of a luminance range.
[0045]On the other hand, when the dynamic range manual mode is chosen by the changeover switch SW shown in drawing 2, selection in an extensive dynamic range priority mode, image quality priority mode, or its middle mode is further attained with the changeover switch SW of photographing mode. At this time, the photographic subject luminance range primary detecting element 10 operates as an acoustic emission sensor for determining exposure of an image taking device. Here, when an extensive dynamic range priority mode is chosen, the large picture of a dynamic range is always acquired and a picture with little black crushing and white crushing can be acquired. On the other hand, in image quality priority mode, although the dynamic range is equivalent to the case of an image sensor single plate, the good picture of image quality can be acquired.
[0046]Hereafter, operation of the device of drawing 1 is explained. The light which passed along the taking lens 3 is divided by the spectrum mirror 5, and is projected on the 1st image sensor 1

and the 2nd image sensor 2, respectively. At this time, it has a relation of the light volume of the light volume supplied to the 1st image sensor 1 comparatively supplied to r1 and the 2nd image sensor 2 which r2 becomes r1>r2 comparatively, and split ratio r1/r2 is taken as a certain fixed value of 2 to 20 within the limits. As for the split ratio r1/r2, it is preferred to consider it as a certain fixed value of 4 to 10 within the limits. The spectrum mirror 5 may be good also as an optical element from which the rate of transmissivity and reflectance differs from origin, for example, or may be divided into two at 50% and 50% using the half mirror with same transmissivity and reflectance, and only an initial complement may attenuate light volume by ND Phi Phil Tarr about one side. However, preferably, an ND filter is not used, a light volume loss does not have the direction used as the single spectrum mirror 5, and it is efficient.

[0047]When there are directions of image taking, the image taking device of a graphic display performs release operation. The control device 7 extracts with a stop driving device (a graphic display is omitted), drives 4, and, specifically, sets it as the optimal amount of illumination light. Next, the control device 7 performs exposure which outputs the picture signal acquired by carrying out photoelectric conversion of the picture which operated the 1st and 2nd image sensors 1 and 2, and projected them. Under the present circumstances, the control device 7 can control independently the storage time T1 of the 1st and 2nd image sensors 1 and 2, and T2 via the timing generator 74, respectively, and can control these to the optimal value. Composition of luminosity is performed by the composing device 6 after the AD translation of the output of the 1st and 2nd image sensors 1 and 2 is carried out for digital data processing. Then, various signal processing and compression are performed by the image processing device 8, and preservation of the image data after Image Processing Division is performed by the memory storage 9. Explanation is omitted although operation which adjusts the position of the taking lens 3 and makes the image of the photographic subject O focus on the 1st and 2nd image sensors with a focusing device (a graphic display is omitted) or hand control is usually performed in advance of photography.

[0048]Here, setting out of the ratio of storage time performed about the 1st and 2nd image sensors 1 and 2 is explained. When automatic mode is chosen, according to the photographic subject luminance range (in this case, luminance difference of the photographic subject O) detected in the luminance range primary detecting element 10, the ratio of the storage time performed about the 1st and 2nd image sensors 1 and 2 is set up so that the image composing of a suitable dynamic range may be obtained. In the case where the manual mode is chosen on the other hand, The ratio of the storage time performed about the 1st and 2nd image sensors 1 and 2 is set up so that the image composing which a photography person means may be obtained according to any were set up among an extensive dynamic range priority mode, image quality priority mode, and middle mode. if the storage time T1 in the 1st and 2nd image sensors 1 and 2 and the ratio (T1/T2) of T2 are suitably changed according to a preset value -- the ratio of a light exposure -- R is given by (r1xT1)/(r2xT2).

[0049]drawing 3 - drawing 5 -- the ratio of a light exposure -- after taking R into consideration, it is a figure explaining the concrete technique in the case of performing luminosity composition by the composing device 6.

[0050]Drawing 3 is a graph explaining the composition at the time of being set as automatic mode about the dynamic range, being set as the manual mode about the dynamic range, when the luminance difference of a photographic subject is large, and choosing an extensive dynamic range priority mode. Drawing 3 (a) shows the luminance output before composition, drawing 3 (b) shows the weight function used in the case of composition, and drawing 3 (c) shows the luminance output after composition. In drawing 3 (a), a horizontal axis shows the luminosity of the photographic subject O, and a vertical axis shows the output A1 of both the image sensors 1 and 2, and A2. In drawing 3 (b), a vertical axis shows the value of the weight function for compounding the output value A1 of both the image sensors 1 and 2, and A2, and a vertical axis shows the output V of the composing device 6 in drawing 3 (c). In this case, the storage time T1 and the ratio of T2 are enlarged, the overlap area of the straight-line portion of the photoelectric transfer characteristic of the two image sensors 1 and 2 is made small, and it enables it to incorporate the information on a wide luminance range. When the luminance range of the

photographic subject O is wide, a large dynamic range is secured by the above composition.
[0051]Drawing 4 is a graph explaining the composition at the time of choosing the middle mode by a manual mode, when the luminance difference of a photographic subject is a degree in the middle in automatic mode. Drawing 4 (a) shows the luminance output before composition, drawing 4 (b) shows the weight function used in the case of composition, and drawing 4 (c) shows the luminance output after composition. In this case, the storage time T1 and the ratio of T2 are made small, and it is made for the lap of the straight-line portion of the photoelectric transfer characteristic by the two image sensors 1 and 2 to become large. If the field with which a straight-line portion laps is large, the phenomenon which discontinuity produces at the time of composition can be prevented effectively. While securing a large dynamic range, it shall be hard to produce discontinuity in a composite knot by composition like a graphic display (image quality and DR priority). If the field with which a straight-line portion laps is large, the phenomenon which discontinuity produces at the time of composition can be prevented effectively.
[0052]Drawing 5 is a graph explaining composition when the case where the luminance difference of a photographic subject is small is chosen with automatic mode and it chooses image quality priority mode by a manual mode. Drawing 5 (a) shows the luminosity before composition, drawing 5 (b) shows the weight function in the case of composition, and drawing 5 (c) shows the luminosity after composition. in this case, the thing for which the storage time T1 and T2 are made equal, or T2 is made rather longer than T1 (T1<T2) -- the exposure ratio R -- namely (r1xT1) -- an opposite (r2xT2) -- a ratio is made close to about 1, or it is made equal to 1. A weight function is also simply set to 1 and the output of two image sensors is added simply. A result and the discontinuity by composition are not produced, and since random noise works in the direction negated mutually, image quality becomes good (image quality priority).
[0053]A high-speed compositing process becomes possible by giving a weight function to the composing device 6 as an LUT (look-up table). In this case, two or more LUTs which responded to setting out at the time of luminance difference or a manual mode are prepared for the composing device 6, and it compounds by changing them if needed.
[0054]LUT cannot be used but the arithmetic circuit which consists of a multiplication circuit and an adder circuit can also be incorporated all over the circuit which constitutes the composing device 6. In this case, it is also possible by changing the parameter of a weight function according to the storage time T1 and the ratio of T2 to perform a compositing process.
[0055]It is also possible not to have a synthetic circuit which performs a compositing process specially, but to use the calculation function of CPU73 instead, and to compound by processing by software.
[0056]When using CCD as the 1st and 2nd image sensors 1 and 2, as the 2nd image sensor 2 (image sensor which picturizes the mirror image reflected by the division optical system), it is possible to use mirror image mode and CCD only for a mirror image, for example. If such CCD is used, even if it is a case where only one of the two becomes a mirror image using a split mirror as shown in drawing 1, it is possible to read the pixel output of the same spatial position to the same timing. Or it is also possible to have composition which reads information to the turn which equips a frame memory, records the information read using usual CCD on the above-mentioned frame memory, and amends a mirror image, and carries out picture composition.
[0057][A 2nd embodiment] Drawing 6 is a figure explaining the structure of the image taking device concerning a 2nd embodiment. This image taking device is a modification of the device of a 1st embodiment, gives the same numerals to identical parts, and omits duplication explanation. The device of this embodiment is provided with the changeover switch TSW as the 3rd selecting means for changing the mode of exposure timing, and CPU73 controls the timing which transmits the picture signal from the 1st and 2nd image sensors 1 and 2 to the composing device 6 based on setting out by the changeover switch TSW. This device is provided with the frame memories 121 and 122 of the couple which saves temporarily the picture signal from the 1st and 2nd image sensors 1 and 2, respectively.
[0058]Drawing 7 is a figure showing the example of the changeover switch TSW for exposure timing. Drawing 7 (a) is the example which provided switch TSW1 for exclusive use for the mode setting of exposure timing, and while drawing 7 (b) looks at the menu displayed on the screen of

liquid crystal display LCD, it is an example which chooses whether exposure timing is set as which mode by command button TSW3 of a couple. In the example of a graphic display, the mode of exposure timing can be set as end coincidence, start coincidence, and three kinds of the Bure minimum.

[0059]Drawing 8 to drawing 10 is a figure explaining the exposure timing of the 1st and 2nd image sensors 1 and 2. At this embodiment, it controls by the three-stage in the 1st mode in which the timing of accumulation by the 1st and 2nd image sensors 1 and 2 is made for the difference of the storage time T1 and the central time of T2 to become below a predetermined value, the 2nd mode that coincides storage start time, and the 3rd mode that coincides accumulation finish time. The photography person can perform photography which chose the desired mode from these three modes, and met the intention.

[0060]Drawing 8 is a figure explaining the exposure timing of the standard which corresponds when the 1st mode of the above is chosen by the changeover switch TSW, and makes Bure the minimum. Drawing 8 (a) shows the exposure timing (accumulation timing) and signal read timing of the 1st image sensor 1, and drawing 8 (b) shows the exposure timing (accumulation timing) and signal read timing of the 2nd image sensor 2. Clearly also from a figure, it controls by exposure timing in the 1st mode so that the difference of the storage time T1 of the 1st and 2nd image sensors 1 and 2 and the central time of T2 becomes within predetermined time. Although it is arbitrary as how many this predetermined time is set, it is preferred to set it as the range for 1 / 10 to [ about 1 / ] about 100 seconds. Usually, as for the above-mentioned predetermined time, since Bure is conspicuous when the focal distance of the taking lens 3 is long, it is preferred [ since Bure cannot be easily conspicuous when the focal distance of the taking lens 3 is short, some above-mentioned predetermined time (difference of central time) may be long, but ] for it to be short and to set up. By performing such a control method, the picture in which Bure cannot be easily conspicuous can be acquired.

[0061]Drawing 9 and drawing 10 are the figures explaining the case where correspond when the above 2nd or the 3rd mode is chosen by the changeover switch TSW, and the exposure start and exposure completion by both the image sensors 1 and 2 are coincided. Drawing 9 is a figure explaining the exposure timing which coincides an exposure start, drawing 9 (a) shows the exposure timing and signal read timing of the 1st image sensor 1, and drawing 9 (b) shows the exposure timing and signal read timing of the 2nd image sensor 2. On the other hand, drawing 10 is a figure explaining another exposure timing which coincides exposure completion, drawing 10 (a) shows the exposure timing and signal read timing of the 1st image sensor 1, and drawing 10 (b) shows the exposure timing and signal read timing of the 2nd image sensor 2.

[0062]In the case of drawing 9, the effect similar to the time of carrying out rear curtain synchronization photography (mode which emits light in a stroboscope just before a shutter closes) with the usual single-lens reflex camera exactly using a stroboscope can be induced, In the case of drawing 10, the effect similar to the time of carrying out front curtain synchronization photography (mode which emits light in a stroboscope immediately after a shutter opens) can be induced.

[0063]Here, if it is going to output a picture simultaneously when the storage time T1 differs from the exposure completion time of T2 (the direction of the storage time T2 considers it as exposure completion previously) as shown in drawing 8 or drawing 9, a time interval will be vacant after exposure of the 2nd image sensor 2 finishes until exposure of the 1st image sensor 1 finishes. Considering the case where CCD is used as the 1st and 2nd image sensors 1 and 2, the signal charge of the 2nd image sensor 2 will be held in vertical transfer CCD in the meantime. Generally vertical transfer CCD has great influence of dark current compared with a photo-diode. As a result, the influence of the noise by a dark current component becomes large. Therefore, in this embodiment, irrespective of whether the time difference of the exposure completion by the 1st and 2nd image sensors 1 and 2 is large, after exposure of the 2nd image sensor 2 finishes, a picture signal is read from here and it saves temporarily at the frame memory 122. Next, after exposure of the 1st image sensor 1 finishes, a picture signal is read from here and it saves at the frame memory 121. Then, the 1st and 2nd image sensors 1 and 2 memorized to both the frame memories 121 and 122 are read simultaneously, and the

compositing process of the read picture signal is carried out by the composing device 6. As a result, it becomes difficult to be influenced by dark current.
[0064][A 3rd embodiment] Drawing 11 is a figure explaining the structure of the image taking device concerning a 3rd embodiment. This image taking device is a modification of the device of a 2nd embodiment, gives the same numerals to identical parts, and omits duplication explanation. The device of this embodiment possesses the connector CNN for connecting built-in stroboscope floor line1 or external stroboscope floor line2 which can be desorbed. The selecting switch SSW which chooses the condition of use of stroboscope floor line1 and floor line2, for example from the strobe modes of the prohibition on forced light emission, automatic luminescence, and luminescence is also provided.
[0065]When forced-light-emission mode is chosen with the selecting switch SSW, or when a camera judges it as stroboscope necessity in automatic luminescence mode, a stroboscope emits light. At this time, the operation timing of issue stroboscope floor line1 and floor line2 is interlocked with the changeover switch TSW for exposure timing described by a 2nd embodiment. That is, it is made to synchronize with these exposure and stroboscope floor line1 and floor line2 are made to emit light in the exposure timing shown in drawing 8 - drawing 10 during the period which both 1st and 2nd image sensors 1 and 2 are exposing.
[0066]By the way, in the field which the illumination light (strobe light) from stroboscope floor line1 and floor line2 does not reach, as a 1st embodiment explained, the exposure ratio of the 1st and 2nd image sensors 1 and 2 becomes (r1xT1/r2xT2). since [ on the other hand, ] the emission time of a stroboscope is usually shorter than both the storage time T1 and T2 in the field exposed only by a strobe light -- the exposure ratio of the 1st and 2nd image sensors 1 and 2 -- being simple (r1/r2) -- it becomes. In the field which both a strobe light and available light contribute to exposure, an exposure ratio serves as a middle value of (r1xT1/r2xT2), and (r1/r2). For this reason, if luminosity was compounded simply, fault may arise.
[0067]Therefore, the device of this embodiment is provided with the identification device which detects and identifies within a picture the field at which a strobe light arrives. carrying out Puri luminescence of stroboscope floor line1 and floor line2 just before this photography, capturing an image by the 1st and 2nd image sensors 1 and 2 grades, and discriminating the field at which stroboscope floor line1 and floor line2 arrive in this screen from the luminosity of the incorporated screen as a realization method of such an identification device, for example -- it carries out.Then, when performing this photography, with reference to the discriminated result of the stroboscope attainment field by the above-mentioned identification device, the luminance difference of each point of the picture acquired by actual photography is also referred to, and it compounds, adjusting the composite form and parameter of a weighting function. By using this appearance, the large picture of a dynamic range can be acquired also at the time of stroboscope floor line1 and floor line2 use.
[0068]As the another control method, it is concerned with dynamic range mode or a picture quality mode, and there is nothing and the exposure time of the 1st and 2nd image sensors 1 and 2 can also always be equally set up at the time of use of stroboscope floor line1 and floor line2. Namely, it fixes to T1=T2 at the time of stroboscope use. If it does in this way, the exposure ratio of the two image sensors 1 and 2 will not be concerned with whether a strobe light arrives, but will become always (r1/r2). In this case, the above identification devices which identify the field at which a strobe light arrives become unnecessary. Since the noise component of the picture signal from the two image sensors 1 and 2 is equalized by combining the picturized picture, S/N goes up and a picture becomes good.
[0069][A 4th embodiment] Drawing 12 is a figure explaining the structure of the image taking device concerning a 4th embodiment.
[0070]This image reader is a modification of the device of a 1st embodiment, and is provided with the luminance range primary detecting element 110 which detects a photographic subject luminance range using the taking lens 3. This device is provided with the frame memories 121 and 122 of the couple which saves temporarily the picture signal from the 1st and 2nd image sensors 1 and 2, respectively.
[0071]The luminance range primary detecting element 110 has the following.

The mirror 110a which is arranged on the optic axis AX and reflects a part of image light.
The 2nd lens 10a that condenses the light anti-**(ed) by the mirror 110a.
Hyperfractionation SPD10b on which the light which passed the 2nd lens 10a is projected.
1og amplifier 10c individually connected to the element of hyperfractionation SPD10b.

[0072]This luminance range primary detecting element 110 also has the work as an acoustic emission sensor for deciding the exposure time of an image taking device. Based on the element output from this luminance range primary detecting element 110, the exposure time of each image sensors 1 and 2 and the ** value of the diaphragm 4 are determined.
[0073]When the manual mode is chosen with the changeover switch SW about the dynamic range, the information about the photographic subject luminance range obtained from the luminance range primary detecting element 110 is unnecessary. Therefore, among the information acquired from the luminance range primary detecting element 110, the information about a photographic subject luminance range is not used, but uses the luminance range primary detecting element 110 only as an exposure sensor (acoustic emission sensor) of an image reader.
[0074]It is not necessary to use the 1st and 2nd image sensors 1 and 2 as only for an image pick-up (image taking), and they can also be utilized as a focus detection (AF) means etc. For example, when performing CCDAF(s) (mountain-climbing AF etc.), or when displaying a liquid crystal finder, only one of the two of both the image sensors 1 and 2 can be operated, and processing required for the control device 7 can be made to perform. It can also be changed according to the luminosity of the photographic subject at that time which image sensors 1 and 2 are used. In this case, the composing device 6 is not operated, either and one of the outputs which are only operating among the image sensors 1 and 2 are made to bypass as they are. As a result, it is possible to cut down power consumption.
[0075][A 5th embodiment] Drawing 13 is a figure explaining the image taking device concerning a 5th embodiment. This image reader performs luminance range detection using the image sensor (CCD) 1 for image taking, and 2 the very thing.
[0076]Hereafter, operation of the device of this embodiment is explained. First, imaging operation for photographic subject luminosity detection is performed by the storage time which changes enough with 1st and 2nd image sensors 1 and 2 (T1/T2 are 10 or more times). Next, the histogram of the output of each image sensor 1 and 2 is investigated, and the upper limit and lower limit of a luminance range which were detected are calculated. The above operation is repeated and storage time is optimized.
[0077]Drawing 14 (a) shows distribution of the actual luminance range of a photographic subject, and drawing 14 (b) shows the example of change of a photographic subject luminance range detectable with both the image sensors 1 and 2. In the state of the time (A) of the 1st step shown in drawing 14 (b), the further high-intensity field exists in a photographic subject rather than the luminance range detected now. Only the specified quantity increases both the storage time T1 and the value of T2, maintaining the ratios T1/T2 in order to feed back the detection result by both the image sensors 1 and 2, a histogram is investigated again, and the upper limit and lower limit of a luminance range are calculated (state of the time (B) of the 2nd step). Such operation is repeated and the luminance range (MAX, MIN) of a photographic subject is detected (refer to the state of the time (C) of the 3rd step). It is good during these operations also as operation which does not read all the pixels from CCD which constitutes both the image sensors 1 and 2, but operates on a curtailed schedule and reads the pixel of CCD. When automatic mode is chosen with the changeover switch SW about the dynamic range at the time of release operation, When the optimal storage time T1 and T2 are chosen and the manual mode is chosen with the changeover switch SW, the storage time T1 and T2 are determined according to the selected photographing mode, and Still Picture Sub-Division is photoed. that is, the photographic subject luminance range (MAX, MIN) detected when automatic mode was chosen -- and, According to the histogram of photographic subject luminosity, and distribution of luminosity, the optimum value of the storage time T1 of both the image sensors 1 and 2, T2, and its ratios T1/T2 is calculated, and Still Picture Sub-Division is photoed by the acquired optimal storage

time T1 and T2 at the time of release operation.
[0078][A 6th embodiment] Drawing 15 is a figure explaining the image taking device concerning a 6th embodiment.
[0079]The image sensors 101 and 102 which consist of color type CCD are used for this image reader as an image sensor for image taking. In order to compound the picture signal from both the image sensors 101 and 102, the composing device 206 is provided also with the interpolation function.
[0080]The pixel which constitutes the two image sensors (CCD) 101 and 102 serves as the same position relatively. That is, the technique called what is called pixel ****** that shifts a pixel 1/2 pitch is not used. Arrangement of the colored filters 101a and 102a on chip type provided on both the image sensors 101 and 102 can also be relatively made into the same position, and arrangement can also be made into the position relatively shifted.
[0081]Drawing 16 - drawing 18 are figures which illustrate notionally the example of arrangement of the colored filters 101a and 102a. Drawing 16 is an example which has arranged all RGB in the same position relatively, drawing 16 (a) shows arrangement of the colored filter 101a, and drawing 16 (b) shows arrangement of the colored filter 102a. It is an example to which drawing 17 has arranged G in the same position, and has arranged RB in the complementary position, and drawing 17 (a) shows arrangement of the colored filter 101a, and drawing 17 (b) shows arrangement of the colored filter 102a. Drawing 18 is an example which has arranged all RGB in the position relatively shifted, drawing 18 (a) shows arrangement of the colored filter 101a, and drawing 18 (b) shows arrangement of the colored filter 102a.
[0082]Although the case where image taking is realized combining the image sensors 1 and 2 of a Bayer array in any case is shown, another light filter arrangement and complementary filter arrangement may be sufficient.
[0083]For example, as shown in drawing 18, when shifting and using the relative location of a colored filter combining two image sensors of a Bayer array, as for G, information is acquired by all the pixels, and, as for R and B, information is acquired by 2 pixels at a rate of 1 pixel.
[0084]Composition of the color image information from which the light exposure obtained from the two image sensors 1 and 2 differs hereafter is explained.
[0085]It is only sufficient for the composition in the case of having arranged all RGB in the same position relatively, as shown in drawing 16 to pile up corresponding picture elements with a suitable weight function simply in a similar manner with the old embodiment having explained. As shown in drawing 17 or drawing 18, when there is a relative location gap about at least one of the RGB, on the occasion of composition or interpolation, a device is needed.
[0086]Specifically, the gradation of RGB each ingredient is compounded using the pixel output which adjoins spatially for every color first (for example, in the arrangement shown in drawing 18). RGB can be interpolated from the value after the composition produced by doing in this way which compounds R11 and r21, compounds G21 and g31, compounds G12 and g22, and compounds B22 and b32, and a full color picture can be generated (the 1st method). Or RGB interpolation may be first performed about both each picture, and the gradation of RGB each ingredient may be compounded about each pixel (the 2nd method). Or the color component of the pixel corresponding to [ pixel / of one 2nd image sensor 2 / each ] the beginning in the 1st image sensor 1 is interpolated (for example, in the arrangement shown in drawing 18). r'11 of the 2nd image sensor 2, g'21, g'12, and b'22 are interpolated and generated from the surrounding pixel, The gradation of RGB each ingredient is compounded between the 1st image sensor 1 of another side about the corresponding position after interpolation (for example, in the arrangement shown in drawing 18). R11 and r'11 can be compounded, G21 and g'21 can be compounded, G12 and g'12 can be compounded, B22 and b'22 can be compounded, and RGB interpolation can also be again carried out to the last (the 3rd method).
[0087]The way of computational complexity which performed the gradation compositing process of each RGB color using the pixel which adjoins spatially about each color first like the 1st method, and performed RGB interpolation processing after that decreases. On the contrary, after performing interpolation processing previously like the 2nd method, when performing a gradation compositing process, the computational complexity and the memory which are needed

increase, but about a false color or resolving, it becomes advantageous. The way while performs interpolation of a picture, and composition of gradation and interpolation of the compound picture like the 3rd method has these interim features.
[0088]In this embodiment (in the case of the arrangement shown in drawing 18), when especially the luminance range of a photographic subject is narrow, it is possible by being referred to as T1**T2 or T1<T2 to make the light exposure of two image sensors almost equal. In this case, since the information on R and B can be acquired at a rate of 1 pixel to the information on G, and 2 pixels about all the pixels, a false color can acquire few good high pictures of resolving by [ of the gain adjustment of the two image sensors 1 and 2, and RB ] carrying out interpolation processing.
[0089]color picture **** in which a dynamic range is large when the case where the luminance difference of a photographic subject is large is chosen with dynamic range automatic mode and an extensive dynamic range priority mode is chosen by a dynamic range manual mode by these things -- things are made. On the other hand, when the case where the luminance difference of a photographic subject is small is chosen with dynamic range automatic mode, image quality priority mode is chosen by a dynamic range manual mode, and the luminance difference of a photographic subject is small, a false color can acquire few good high pictures of resolving.
[0090]As the modification of a 3rd embodiment showed, stroboscope floor line1 and floor line2 are provided, at the time of use of stroboscope floor line1 and floor line2, it can control so that the exposure time of the two image sensors 1 and 2 becomes equal, and it can acquire the picture over which priority was given to image quality.
[0091]Although each embodiment was described individually above, it cannot be overemphasized that it is possible to combine these arbitrarily. For example, it has built-in stroboscope floor line1 and they are four selecting switches (for switch SW1 for a dynamic range mode change, switch SW2 for a photographing mode change, and a timing-modes change, it switch-TSW(s) and). It has the switch SSW for a strobe mode change, and supposes that it is switchable respectively, a thing provided with a hyperfractionation SPD element is used as the photographic subject luminosity primary detecting element 10, composition of a picture is considered as the soft processing by CPU73, and the combination of color CCD is also possible for the image sensors 1 and 2.
[0092]A various combination is possible also about the existence of the four above-mentioned selecting switches. For example, the composition which carries out the mode about a dynamic range only for manual selection, and is always chosen with the switch for a change of photographing mode is also possible. In this case, it becomes unnecessary [ the automatic and manual switch for a mode change of a dynamic range ], and the switch for selection of photographing mode will remain. As another example, if the mode about a dynamic range is carried out only for auto select, the switch for a change in the automatic and manual mode of a dynamic range and the switch for a change of photographing mode will become unnecessary. In this case, it becomes composition provided with the switch for a change of timing modes, and the switch for a change of a strobe mode. The camera which sets up all the modes automatically according to a situation is also possible. in this case, all the four above selecting switches -- it becomes unnecessary composition.
[0093][A 7th embodiment] Drawing 19 shows the image taking device concerning a 7th embodiment, and shows the example applied to the camera.
[0094]This camera 300 is provided with the following.
In the case 300a furnished with the taking lens 3, it is the diaphragm 4.
The beam splitter 5 which is a division optical system.
1st and 2nd CCD image sensors 1 and 2.
The picture detection synthetic circuit 306 and the control device 7.
Here, the picture detection synthetic circuit 306 is provided with the following.
If the image taking device of a 3rd embodiment shown in drawing 11 is also used and explained, they will be AD converters 21 and 22.
Frame memories 121 and 122.
The composing device 6 which compounds and outputs the output after an AD translation.

Liquid crystal display LCD which functions as a finder for a monitor is attached to the case 300a back. this liquid crystal display LCD -- the operational mode (dynamic range automatic mode.) of a camera It is used also in order to choose a dynamic range manual mode, an extensive dynamic range priority mode, image quality priority mode, etc., and the operating state of the control device 7 can be set up by the photography person side by command button SW3, looking at the menu displayed on liquid crystal display LCD.

[0095]According to this embodiment, photographic subject luminance range detection and AF detection are performed by the 1st and 2nd image sensors 1 and 2 the very thing which consist of CCD, and what carried out luminosity composition of the output of both the image sensors 1 and 2 is displayed on the liquid crystal display 310. From this, the camera which can acquire the picture of a wide dynamic range is realizable. When both the image sensors 1 and 2 are set to color CCD, the camera which can acquire a picture also with sufficient resolving with few false colors can be realized. The picture of a wide dynamic range can also be acquired with both an animation and Still Picture Sub-Division. Or it is good also as composition which takes a photograph like an ordinary video camera using the picture information of only one image sensor, uses the picture information of both image sensors only in the case of Still Picture Sub-Division, carries out luminosity composition to it, and obtains Still Picture Sub-Division of a wide dynamic range at the time of animation photography.

[0096]Techniques, such as picture composition, can be attained by combining suitably what was explained by the 1st - a 6th embodiment. However, if the processing almost same as photographic subject luminance range detection and the storage time control method as what is shown in drawing 14 etc. is performed, are sufficient, but in order to also make an animation correspond, it is necessary to perform feedback control according to change of a photographic subject luminance range, and to perform processing made to follow change.

[0097][An 8th embodiment] Drawing 20 shows the image taking device concerning an 8th embodiment, and shows the example applied to the digital still camera.

[0098]This camera 400 is provided with the following.

Main part 400a.

The exchangeable camera lens 400b.

The camera lens 400b is an ordinary interchangeable lens for single-lens reflex cameras, and is being fixed to the main part 400a via the lens mount 400c for single-lens reflex cameras. The light which passed the camera lens 400b passes the main mirror 401, and is led to the beam splitter 5 via the re-image formation optical system for reduction which consists of the lenses 403 and 404 and the fixed mirror 405 which are equivalent to the portion on the backside rather than a film plane. On the other hand, after the light reflected by the main mirror 401 passes the focusing screen 410 and the pentaprism 411 and passes the lens 412, it is led to the optical finder 413.

[0099]The sub mirror 420 is arranged and AF sensor 421 performs focus detection to the rear-face side of the main mirror 401. AF sensor 421 is not limited to the thing of an embodiment. For example, it is good also as composition which may arrange the sensor for AF in another position, and performs AF detection by the image sensor 1 and 2 the very thing.

[0100]According to this embodiment, in order to detect a photographic subject luminance range, the division sensor 440 for AE as well as an ordinary single-lens reflex camera is used. The acoustic emission sensor 440 is not limited to the thing of an embodiment. For example, it is good also as composition which performs photographic subject luminance range detection by CCD image sensor 1 and 2 the very thing. The change of the automatic mode about a dynamic range, a manual mode, etc. is chosen with a button, looking at the menu displayed on liquid crystal display LCD. This liquid crystal display LCD is good also as a color matrix liquid crystal display which can display a picture, and good also as a monochrome liquid crystal display only for a display in the mode.

[0101]By such composition, the interchangeable lens for single-lens reflex cameras can be utilized as a lens for digital still cameras, and the picture of a wide dynamic range or the good picture of resolving with few false colors can be acquired by applying the invention illustrated to the 1st - a 6th embodiment. And since the operation method of the camera itself is completely

the same as the usual single-lens reflex camera, operation of being comfortable is attained.
[0102]
[Effect of the Invention]According to the image taking device of this invention, with the automatic mode controlled automatically, a dynamic range so that clearly from the above explanation. According to the luminance difference of a photographic subject, storage time can be set up every 1st and 2nd imaging means, the image of a suitable dynamic range can be captured, and the good picture according to the luminance difference of the photographic subject can be acquired.
[0103]According to another image taking device of this invention, based on the range of the request set up by the adjustment device, storage time can be set up every 1st and 2nd imaging means, and the image which has a desired dynamic range can be captured.

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[Translation done.]

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a block diagram showing the composition of the image taking device concerning a 1st embodiment of this invention.
[Drawing 2](a), (b), and (c) are the figures showing the example of the changeover switch of dynamic range mode and photographing mode.
[Drawing 3](a), (b), and (c) are the figures showing composition when the photographic subject luminance range in the device of drawing 1 is wide.
[Drawing 4](a), (b), and (c) are figures in which the photographic subject luminance range in the device of drawing 1 shows composition of a degree case etc. in the middle.
[Drawing 5](a), (b), and (c) are the figures showing composition when the photographic subject luminance range in the device of drawing 1 is narrow.
[Drawing 6]It is a block diagram showing the composition of the image taking device concerning a 2nd embodiment of this invention.
[Drawing 7](a) and (b) are the figures showing the example of the changeover switch of image storage timing.
[Drawing 8](a) and (b) are the exposure in the case of storing the difference of the central time of exposure in the device of drawing 6 in predetermined time, and an explanatory view of read-out timing.
[Drawing 9](a) and (b) are the exposure in the case of doubling the start of exposure in the device of drawing 6, and an explanatory view of read-out timing.
[Drawing 10](a) and (b) are the exposure in the case of doubling the end of exposure in the device of drawing 6, and an explanatory view of read-out timing.
[Drawing 11]It is a block diagram showing the composition of the image taking device concerning a 3rd embodiment of this invention.
[Drawing 12]It is a block diagram showing the composition of the image taking device concerning a 4th embodiment of this invention.
[Drawing 13]It is a block diagram showing the composition of the image taking device concerning a 5th embodiment of this invention.
[Drawing 14]It is an explanatory view showing the luminance range detecting operation in the device of drawing 14.
[Drawing 15]It is a block diagram showing the composition of the image taking device concerning a 7th embodiment of this invention.
[Drawing 16]It is a figure showing an example of the light filter arrangement in the device of drawing 15.
[Drawing 17]It is a figure showing another example of the light filter arrangement in the device of drawing 15.
[Drawing 18]It is a figure showing another example of the light filter arrangement in the device of drawing 15.
[Drawing 19]It is a figure explaining the composition of the digital still camera concerning an 8th embodiment of this invention.
[Drawing 20]It is a figure explaining the composition of the digital still camera concerning a 9th

embodiment of this invention.
[Drawing 21]It is a figure showing the composition of the conventional image taking device.
[Drawing 22]It is a figure showing another composition of the conventional image taking device.
[Drawing 23]It is a figure for explaining the synthesizing method of luminosity.
[Description of Notations]
1 The 1st image sensor
2 The 2nd image sensor
3 Taking lens
4 Diaphragm
5 Spectrum mirror
6 Composing device
7 Control device
10 Luminance range primary detecting element
21 and 22 Converter
62 Frame memory
73 CPU
84 Defective pixel correcting circuit
101a, a 102a colored filter
110 The matter part for luminance range detection
410 Focusing screen
411 Pentaprism
413 Optical finder
440 The division sensor for AE
LCD liquid crystal display
AX Optic axis
O Photographic subject
SW, SSW, a TSW changeover switch
T1 and T2 Storage time
r1 and r2 Light volume split ratio

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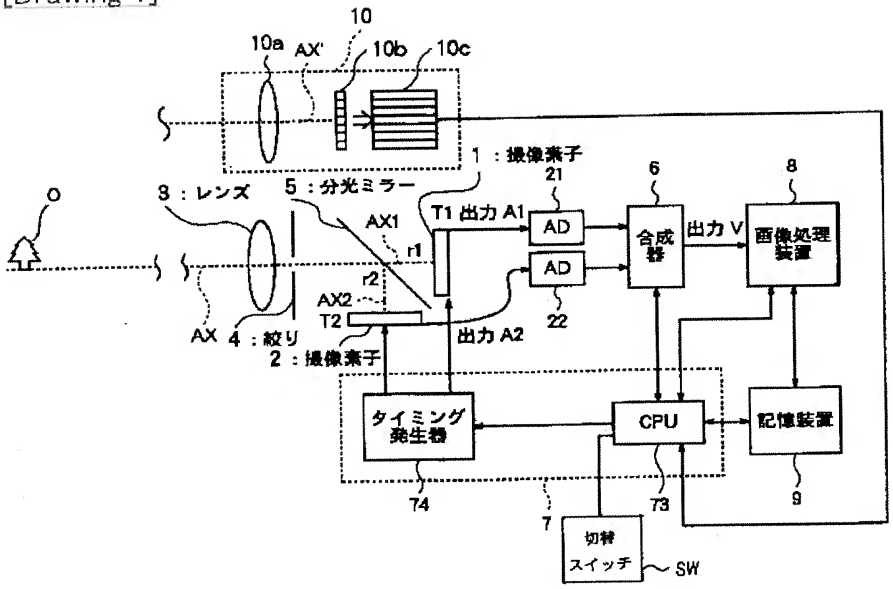
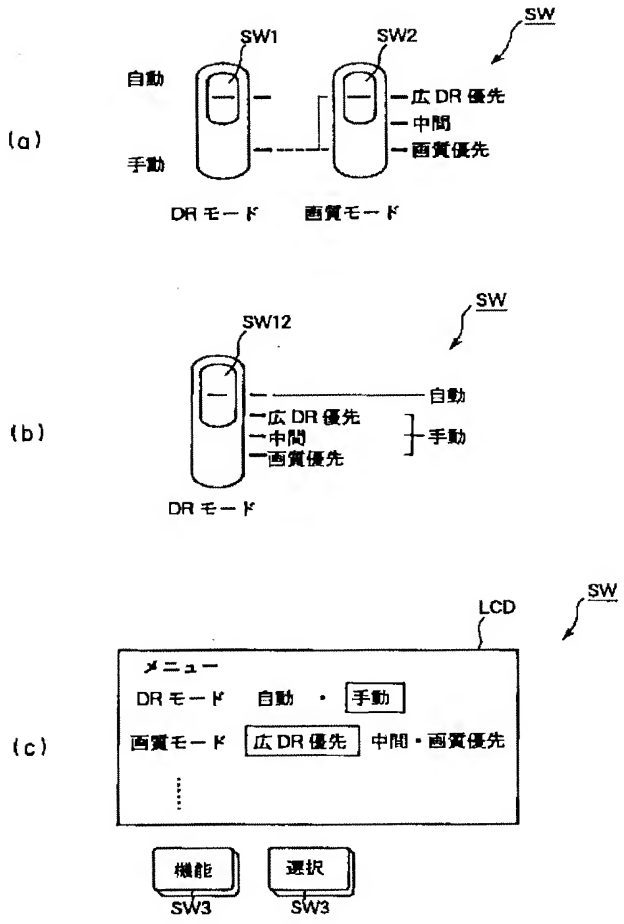
[Translation done.]

## DRAWINGS

[Drawing 1]




[Drawing 2]

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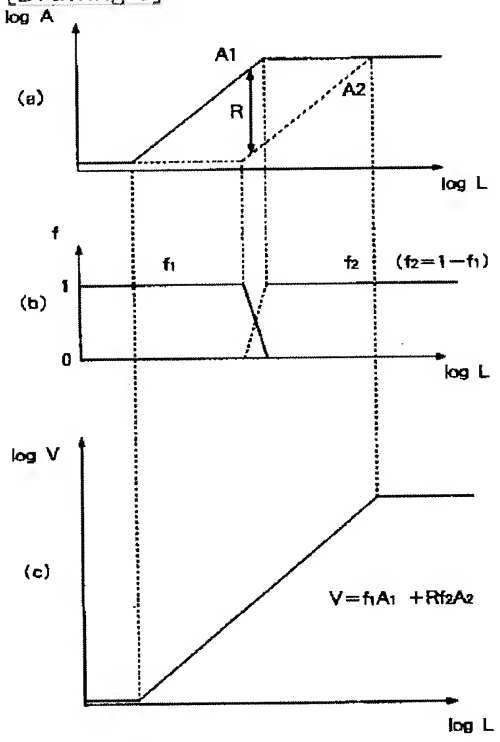
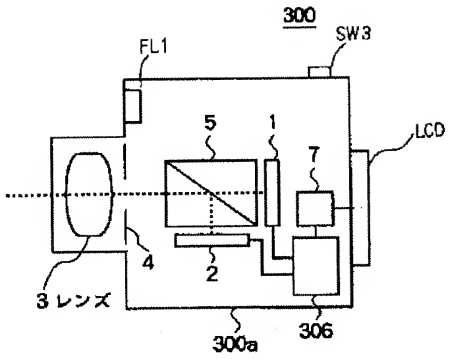



[Drawing 19]

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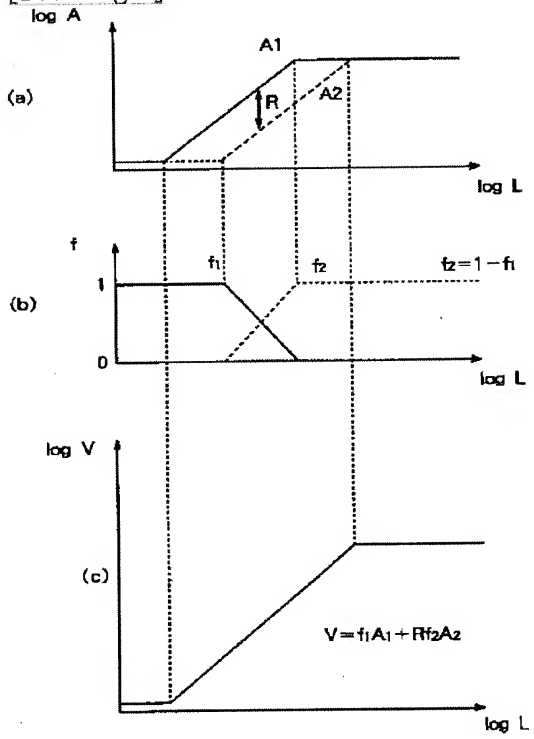


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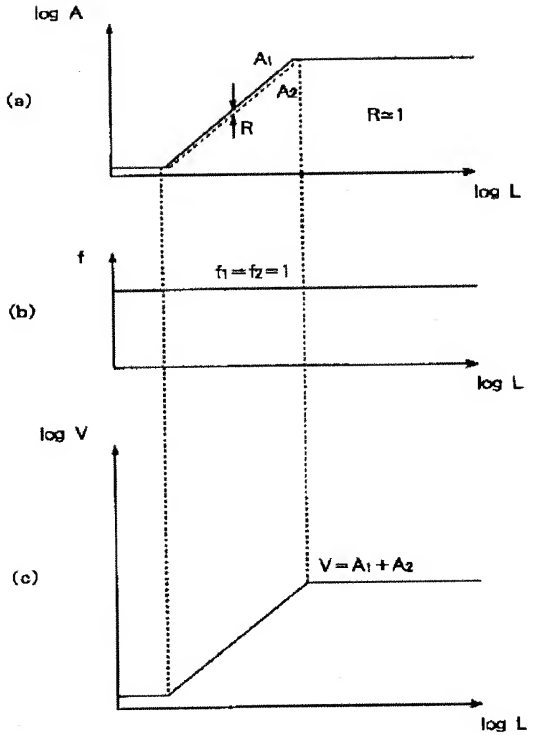


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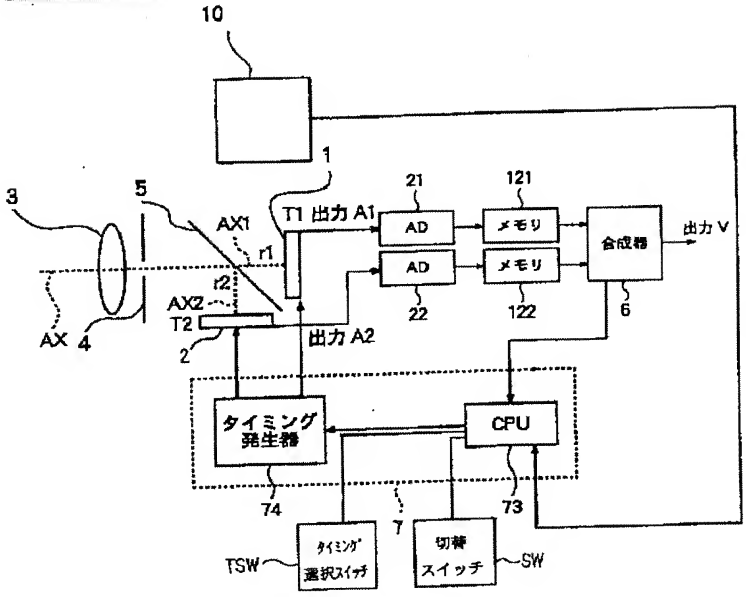


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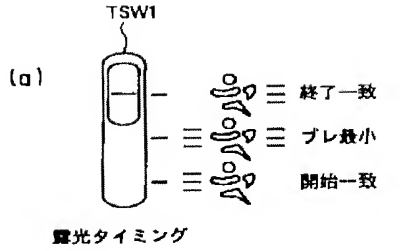


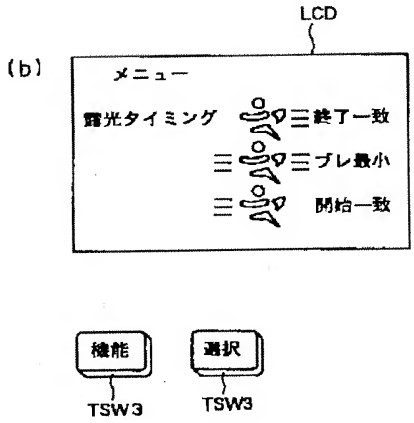


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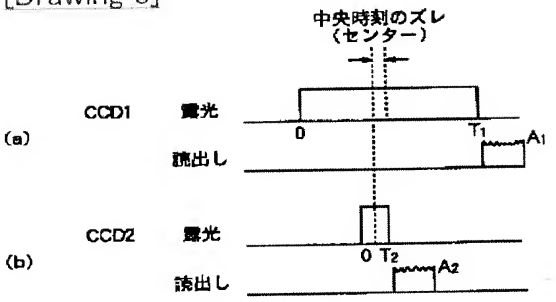


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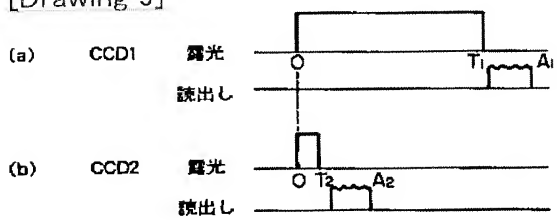


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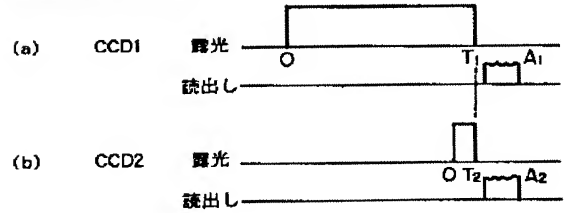
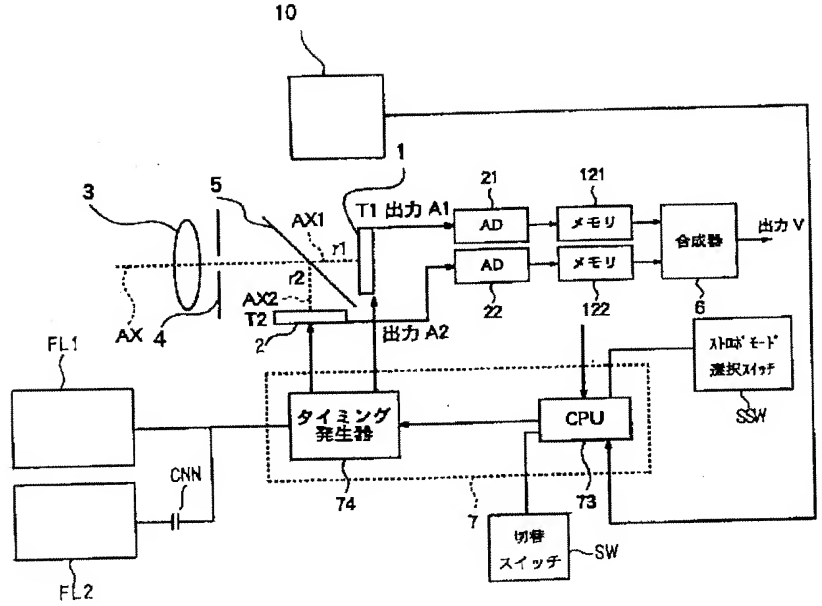



[Drawing 11]

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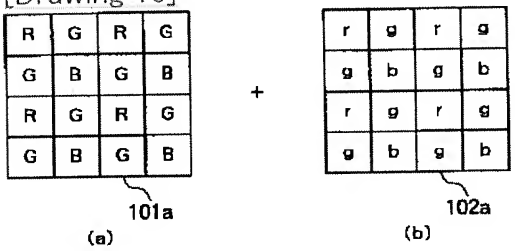
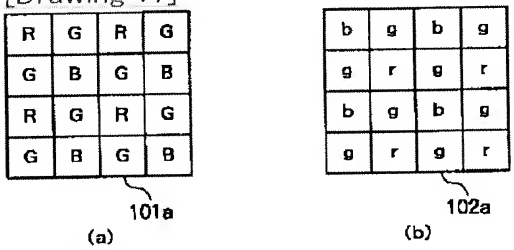



[Drawing 17]

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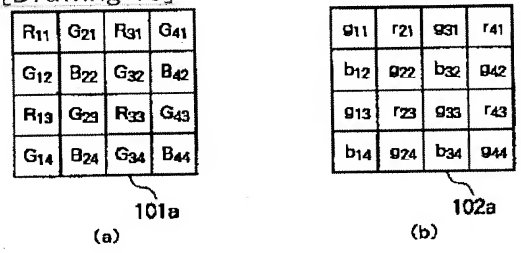


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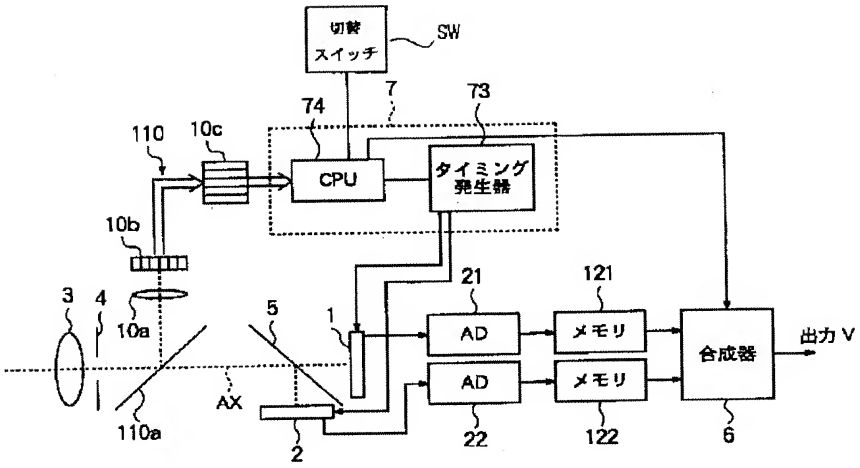
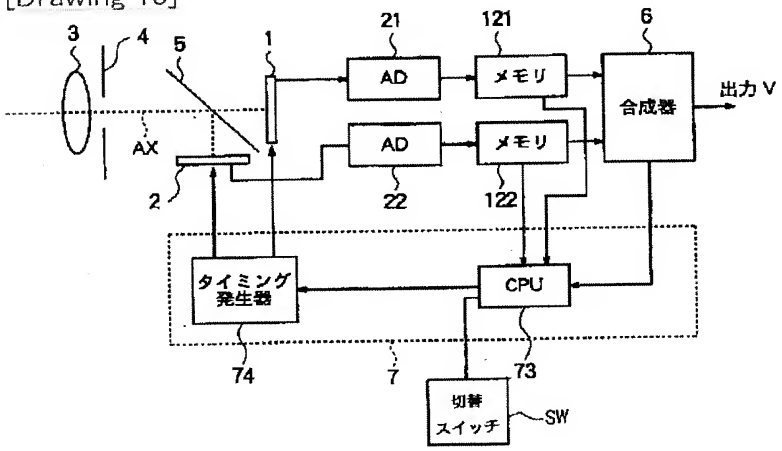
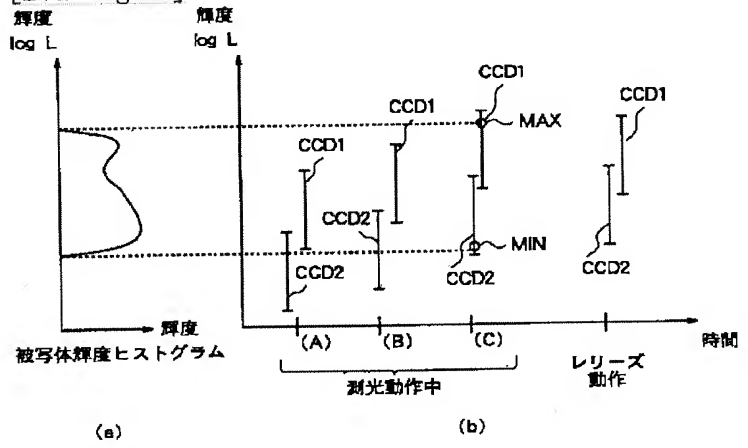



[Drawing 13]




[Drawing 14]

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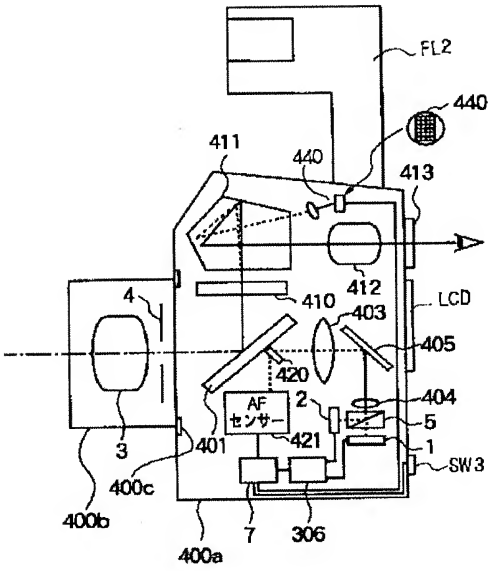


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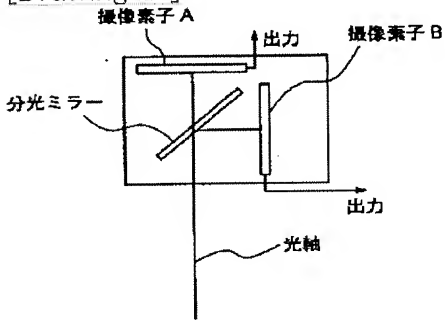


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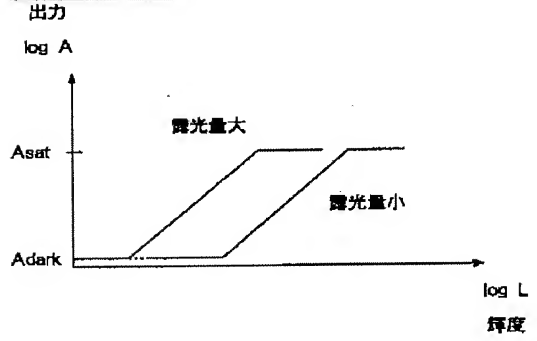


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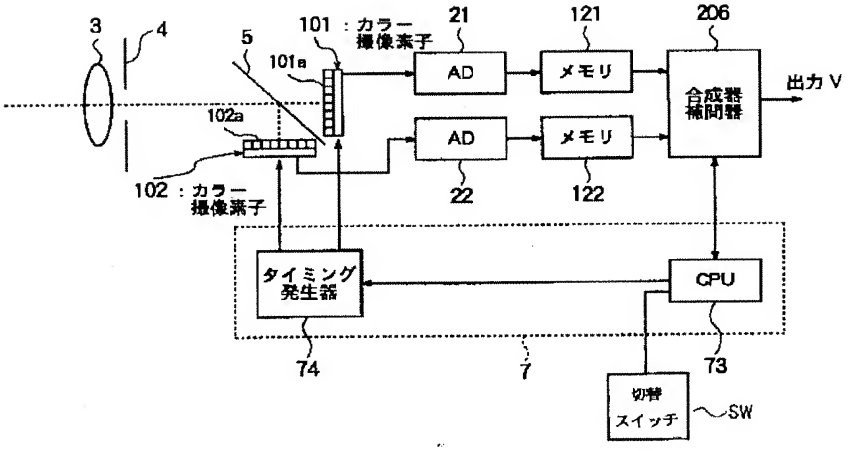


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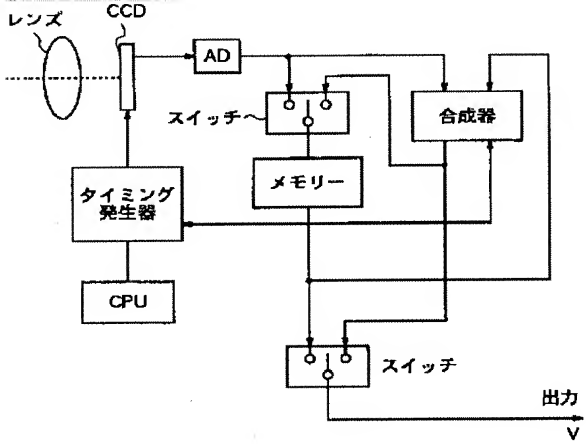


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[Translation done.]

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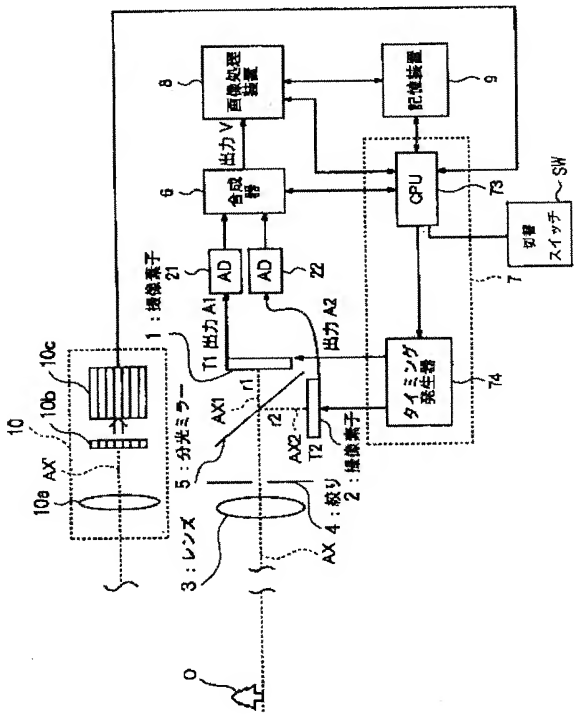
AC00 AC03 AC32 AC42 AC51
AC56 AC69
5C024 AA03 BA01 CA15 CA17 DA01
DA04 DA07 EA03 FA13 GA11
GA47 HA14 HA17

(54)【発明の名称】　画像取り込み装置

(57)【要約】
【課題】　被写体の輝度差に拘わらず常に良好な画像を得ること。
【解決手段】　制御装置７は、タイミング発生器７４を介して撮像素子１、２の蓄積時間Ｔ１、Ｔ２をそれぞれ独立に制御してこれらを最適な値に制御することができる。撮像素子１、２の出力は、デジタルデータ処理のためＡＤ変換された後、合成器６によって輝度の合成が行われる。自動モードが選択されている場合、輝度範囲検出部１０で検出した被写体輝度範囲に応じて、適切なダイナミックレンジの合成画像が得られるように、撮像素子１、２について行う蓄積時間の比を設定する。一方、手動モードが選択されている場合においては、広ダイナミックレンジ優先モード、画質優先モード、及び中間モードのうちいずれが設定されたかに応じて、撮影者の意図する合成画像が得られるように、撮像素子１、２について行う蓄積時間の比を設定する。



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【特許請求の範囲】

【請求項１】　被写体からの入射光軸上に配置されて光路を２方向に分離する分割光学系と、
前記分割光学系により分割された一方の光路の光軸上と他方の光路の光軸上とにそれぞれ配置される第１及び第２撮像手段と、
撮影画像のダイナミックレンジを、装置が自動的に所定の範囲に設定する自動モードと、撮影者が手動で所望の範囲に設定する手動モードとのどちらかを選択して切り替え可能な第１選択手段と、
被写体の輝度範囲である被写体輝度範囲を検出する被写体輝度範囲検出手段と、
前記第１及び第２撮像手段のそれぞれの出力をＡＤ変換するＡＤ変換手段と、
前記第１及び第２撮像手段のＡＤ変換後の出力を合成して出力する合成手段と、
前記第１撮像手段による画像情報の蓄積時間と前記第２撮像手段による画像情報の蓄積時間とを、前記第１選択手段によって自動モードが選択された場合に前記被写体輝度範囲検出手段によって検出された被写体輝度範囲に応じて設定する制御手段と、を備えることを特徴とする画像取り込み装置。

【請求項２】　被写体からの入射光軸上に配置されて光路を２方向に分離する分割光学系と、
前記分割光学系により分割された一方の光路の光軸上と他方の光路の光軸上とにそれぞれ配置される第１及び第２撮像手段と、
撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定するための調整手段と、
前記第１及び第２撮像手段のそれぞれの出力をＡＤ変換するＡＤ変換手段と、
前記第１及び第２撮像手段のＡＤ変換後の出力を合成して出力する合成手段と、
前記第１撮像手段による画像情報の蓄積時間と前記第２撮像手段による画像情報の蓄積時間とを、前記調整手段によって設定された前記所望の範囲に応じて設定する制御手段と、を備えることを特徴とする画像取り込み装置。

【請求項３】　前記第１選択手段で前記自動モードを選択している場合、前記制御手段は、前記第１撮像手段の蓄積時間Ｔ１と前記第２撮像手段の蓄積時間Ｔ２との比（Ｔ１／Ｔ２）を、前記被写体輝度範囲検出手段によって検出された被写体輝度範囲に応じて選択することを特徴とする請求項１記載の画像取り込み装置。

【請求項４】　撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合は、ダイナミックレンジの広さを選択的に切り替えることが可能な第２選択手段を備えることを特徴とする請求項１記載の画像取り込み装置。

【請求項５】　撮影画像のダイナミックレンジを撮影者

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が手動で所望の範囲に設定する場合は、前記第２選択手段によって選択されたダイナミックレンジの広さに応じて、前記第１撮像手段の蓄積時間Ｔ１と前記第２撮像手段の蓄積時間Ｔ２との比（Ｔ１／Ｔ２）を選択することを特徴とする請求項４に記載の画像取り込み装置。

【請求項６】　レリーズ動作時における、前記第１撮像手段の蓄積時間Ｔ１と前記第２撮像手段の蓄積時間Ｔ２とのタイミングの相対関係を選択する第３選択手段をさらに備え、前記制御手段は、レリーズ動作時に、前記第３選択手段によって選択されたタイミングに従って前記第１及び第２撮像手段を制御することを特徴とする請求項１及び請求項２のいずれか記載の画像取り込み装置。

【請求項７】　前記被写体輝度範囲検出手段は、前記第１及び第２撮像素子自身を使用することによって実現され、前記第１撮像素子の蓄積時間Ｔ１と第２撮像素子の蓄積時間Ｔ２との比（Ｔ１／Ｔ２）を所定値以上に保ったまま前記蓄積時間Ｔ１、Ｔ２を変化させて被写体輝度範囲を検出することを特徴とする請求項１に記載の画像取り込み装置。

【請求項８】　前記合成手段は、前記第１及び第２撮像手段の出力する画像情報の輝度が重複する輝度重複部分で、輝度に関して連続的に変化する重み関数を用いて合成を行い、かつ、当該重み関数は、前記第１選択手段が前記自動モードを選択している場合、前記被写体輝度範囲に応じて、形若しくはパラメーターが変わることを特徴とする請求項１記載の画像取り込み装置。

【請求項９】　前記合成手段は、前記第１及び第２撮像手段の出力する画像情報の輝度が重複する輝度重複部分で、輝度に関して連続的に変化する重み関数を用いて合成を行い、かつ、当該重み関数は、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合、設定された当該所望の範囲の広さに応じて、形若しくはパラメーターが変わることを特徴とする請求項１及び請求項２のいずれか記載の画像取り込み装置。

【請求項１０】　ストロボと、ストロボの使用状態を選択する第４選択手段と、画像内でストロボの到達する領域を検出して識別するストロボ到達領域識別手段とをさらに有し、前記合成手段は、前記第１及び第２撮像手段の出力する画像情報の輝度重複部分で、輝度に関して連続的に変化する重み関数を用いて合成を行い、かつ、当該重み関数は、前記ストロボ到達領域識別手段で識別された結果に応じて、形若しくはパラメータが変わることを特徴とする請求項１及び請求項２のいずれか記載の画像取り込み装置。

【請求項１１】　ストロボと、ストロボの使用状態を選択する第４選択手段とをさらに有し、前記制御手段は、ストロボ使用時に、自動的に前記第１撮像素子の蓄積時間と第２撮像素子の蓄積時間とが等しくなるように当該第１及び第２撮像素子を制御し、前記合成手段は、前記第１及び第２撮像手段の出力する画像情報を強度的に加

算することにより合成を行うことを特徴とする請求項１及び請求項２のいずれか記載の画像取り込み装置。

【請求項１２】　前記合成手段は、前記制御手段を構成する中央演算処理装置によるソフトウエア処理により合成処理を行うことを特徴とする請求項１及び請求項２のいずれか記載の画像取り込み装置。

【請求項１３】　前記第１及び第２撮像手段は、ともに単体でフルカラー画像を取り込むことが可能なカラー撮像手段であることを特徴とする請求項１記載の画像取り込み装置。

【請求項１４】　前記第１及び第２撮像手段は、ともに単体でフルカラー画像を取り込むことが可能なカラー撮像手段であることを特徴とする請求項２記載の画像取り込み装置。

【請求項１５】　前記カラー撮像手段は、オンチップカラーフィルタを有し、画素は相対的に同じ空間に配置されるが、オンチップカラーフィルタの色は相対的にずれた空間位置に配置されることを特徴とする請求項１３及び請求項１４のいずれか記載の画像取り込み装置。

【請求項１６】　前記第１選択手段が前記自動モードを選択している場合において、前記被写体輝度範囲が所定値よりも狭い場合と広い場合とで、前記合成手段による合成のアルゴリズムを切り替えることを特徴とする請求項１記載の画像取り込み装置。

【請求項１７】　前記合成手段は、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合において、前記第２選択手段によって選択されたダイナミックレンジの広さに応じて、前記合成手段による合成のアルゴリズムを切り替えることを特徴とする請求項４記載の画像取り込み装置。

【請求項１８】　前記第１及び第２撮像手段は、ともに単体でフルカラー画像を取り込むことが可能なカラー撮像手段であり、前記第１選択手段が前記自動モードを選択している場合において、前記被写体輝度範囲が狭い場合は、前記合成手段が、偽色防止と解像度向上を優先したアルゴリズムを用いて画像合成を行い、前記被写体輝度範囲が広い場合は、前記合成手段が、ダイナミックレンジ拡大を優先したアルゴリズムを用いて画像合成を行うことを特徴とする請求項１記載の画像取り込み装置。

【請求項１９】　前記第１及び第２撮像手段は、ともに単体でフルカラー画像を取り込むことが可能なカラー撮像手段であり、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合において、前記第２選択手段によって狭いダイナミックレンジが選択されている場合は、前記合成手段が、偽色防止と解像度向上を優先したアルゴリズムを用いて画像合成を行い、前記第２の選択手段によって広いダイナミックレンジが選択されている場合は、前記合成手段が、ダイナミックレンジ拡大を優先したアルゴリズムを用いて画像合成を行うことを特徴とする請求項４記載の画像取り込み装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、静止画像等をデジタル信号として取り込む画像取り込み装置に関し、特にデジタルスチルカメラのダイナミックレンジ拡大や画質改善を、撮影者の意図を反映しながら行う技術に関する。

【０００２】

【従来の技術】撮像素子が小型であるほど低価格のカメラが実現可能であるが、画素数の増大に伴い個々の画素サイズが小さくなり、従来から不足気味であった撮像素子のダイナミックレンジは更に不足の傾向にある。

【０００３】その解決策として、露光量を変えた複数の撮像結果を利用する方法が知られている。

【０００４】例えば特開平８－２２３４９１では、図２１に示すように分光ミラーにより２つの撮像素子Ａ、Ｂへの入射光量が異なるようになし、入射光量の少ない撮像素子の出力を増幅して、入射光量の多い撮像素子の出力と合成してダイナミックレンジの拡大を実現している。

【０００５】また、別の方法として、図２２に示すように１つの撮像素子ＣＣＤを用いて、異なる蓄積時間で連続して画像を取り込むものも知られている。具体的な動作について説明すると、まず長い露光時間で画像を取り込み、一時的にメモリーに記憶する。続けて短い露光時間で画像を取り込み、先に取り込んでメモリーに記憶した画像と合成して、ダイナミックレンジの拡大した合成を合成する。（例として、論文「車搭載用のダイナミックレンジ拡大方式」電子情報通信学会論文誌１９９５年１０月号ｐｐ．１４３９）

ダイナミックレンジ拡大の原理を図２３に示す。ある被写体に対して露光量を変えた画像を２枚取り込む。この時、高輝度部分では、露光量の大きい方の画像は飽和するが、露光量の小さい方の画像はまだ飽和せず、輝度が相当高くなってから初めて飽和する。２枚それぞれの露光量差を考慮の上、低輝度部分では露光量の大きい画像を用い、高輝度部分では露光量の小さい画像を用いて画像を合成する。この結果、等価的にダイナミックレンジの拡大された画像が得られる。

【０００６】

【発明が解決しようとする課題】被写体の輝度差はシーンによって異なり、１つの撮像素子のダイナミックレンジでカバー出きる場合（例えば４００倍程度以下）から数千倍も異なる場合まで様々である。

【０００７】被写体の輝度差が小さい場合は、一対の撮像素子の露光量が余り変わらない範囲で撮影した方が、合成の境界の目立たない、良好な画像が合成できる。その一方で、被写体の輝度差が大きい場合は、一対の撮像素子の露光量を大きく変えて撮影した方がダイナミックレンジの広い良好な画像が合成できる。

【０００８】しかし、図２１に示す従来例では、一対の撮像素子の露光量の比が固定されているため、被写体の輝度差に関係なくいつも固定した被写体輝度範囲の画像が取り込まれる。そのため、被写体の輝度差の変動に対応した良好な画像を得ることができない。

【０００９】また、図２２に示す従来例では、連続して画像を取り込むため、移動する物体を撮影したときに高輝度部分と低輝度部分に画像のズレが生じることになる。

【００１０】そこで、本発明は、被写体の輝度差に拘わらず常に良好な画像を得ることを目的とする。

【００１１】

【課題を解決するための手段】上記課題を解決するため、本発明の画像取り込み装置は、被写体からの入射光軸上に配置されて光路を２方向に分離する分割光学系と、前記分割光学系により分割された一方の光路の光軸上と他方の光路の光軸上とにそれぞれ配置される第１及び第２撮像手段と、撮影画像のダイナミックレンジを、装置が自動的に所定の範囲に設定する自動モードと、撮影者が手動で所望の範囲に設定する手動モードとのどちらかを選択して切り替え可能な第１選択手段と、被写体の輝度範囲である被写体輝度範囲を検出する被写体輝度範囲検出手段と、前記第１及び第２撮像手段のそれぞれの出力をＡＤ変換するＡＤ変換手段と、前記第１及び第２撮像手段のＡＤ変換後の出力を合成して出力する合成手段と、前記第１撮像手段による画像情報の蓄積時間と前記第２撮像手段による画像情報の蓄積時間とを、前記第１選択手段によって自動モードが選択された場合に前記被写体輝度範囲検出手段によって検出された被写体輝度範囲に応じて設定する制御手段とを備えることを特徴とする。これにより、ダイナミックレンジを自動的に制御する自動モードでは、被写体の輝度差に応じて第１及び第２撮像手段ごとに蓄積時間を設定して適切なダイナミックレンジの画像を取り込むことができ、被写体の輝度差に応じた良好な画像を得ることができる。

【００１２】また、本発明の別の画像取り込み装置は、被写体からの入射光軸上に配置されて光路を２方向に分離する分割光学系と、前記分割光学系により分割された一方の光路の光軸上と他方の光路の光軸上とにそれぞれ配置される第１及び第２撮像手段と、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定するための調整手段と、前記第１及び第２撮像手段のそれぞれの出力をＡＤ変換するＡＤ変換手段と、前記第１及び第２撮像手段のＡＤ変換後の出力を合成して出力する合成手段と、前記第１撮像手段による画像情報の蓄積時間と前記第２撮像手段による画像情報の蓄積時間とを、前記調整手段によって設定された前記所望の範囲に応じて設定する制御手段とを備えることを特徴とする。これにより、調整手段で設定された所望の範囲に基づいて第１及び第２撮像手段ごとに蓄積時間を設定することができ、所望のダイナミックレンジを有する画像を取り込むことができる。

【００１３】また、好ましい態様によれば、前記第１選択手段で前記自動モードを選択している場合、前記制御手段が、前記第１撮像手段の蓄積時間Ｔ１と前記第２撮像手段の蓄積時間Ｔ２との比（Ｔ１／Ｔ２）を、前記被写体輝度範囲検出手段によって検出された被写体輝度範囲に応じて選択することを特徴とする。

【００１４】また、好ましい態様によれば、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合は、ダイナミックレンジの広さを選択的に切り替えることが可能な第２選択手段を備えることを特徴とする。

【００１５】また、好ましい態様によれば、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合は、前記第２選択手段によって選択されたダイナミックレンジの広さに応じて、前記第１撮像手段の蓄積時間Ｔ１と前記第２撮像手段の蓄積時間Ｔ２との比（Ｔ１／Ｔ２）を選択することを特徴とする。

【００１６】また、好ましい態様によれば、レリーズ動作時における、前記第１撮像手段の蓄積時間Ｔ１と前記第２撮像手段の蓄積時間Ｔ２とのタイミングの相対関係を選択する第３選択手段をさらに備え、前記制御手段は、レリーズ動作時に、前記第３選択手段によって選択されたタイミングに従って前記第１及び第２撮像手段を制御することを特徴とする。これにより、動きのある被写体でブレの影響を最小とした画像、或いはブレを表現手段として用いた画像を得ることができる。

【００１７】また、好ましい態様によれば、前記被写体輝度範囲検出手段が、前記第１及び第２撮像素子自身を使用することによって実現され、前記第１撮像素子の蓄積時間Ｔ１と第２撮像素子の蓄積時間Ｔ２との比（Ｔ１／Ｔ２）を所定値以上に保ったまま前記蓄積時間Ｔ１、Ｔ２を変化させて被写体輝度範囲を検出することを特徴とする。これにより、画像取り込み装置の構造を簡単かつ経済的なものとすることができる。

【００１８】また、好ましい態様によれば、前記合成手段が、前記第１及び第２撮像手段の出力する画像情報の輝度が重複する輝度重複部分で、輝度に関して連続的に変化する重み関数を用いて合成を行い、かつ、当該重み関数が、前記第１選択手段が前記自動モードを選択している場合、前記被写体輝度範囲に応じて、形若しくはパラメーターが変わることを特徴とする。これにより、自動モードで第１及び第２撮像手段の出力する画像を合成する際の境界での不連続を少なくすることができる。

【００１９】また、好ましい態様によれば、前記合成手段が、前記第１及び第２撮像手段の出力する画像情報の輝度が重複する輝度重複部分で、輝度に関して連続的に変化する重み関数を用いて合成を行い、かつ、当該重み関数は、撮影画像のダイナミックレンジを撮影者が手動

で所望の範囲に設定する場合、設定された当該所望の範囲の広さに応じて、形若しくはパラメーターが変わることを特徴とする。これにより、手動でダイナミックレンジを設定し第１及び第２撮像手段の出力する画像を合成する際の境界での不連続を少なくすることができる。

【００２０】また、好ましい態様によれば、ストロボと、ストロボの使用状態を選択する第４選択手段と、画像内でストロボの到達する領域を検出して識別するストロボ到達領域識別手段とをさらに有し、前記合成手段は、前記第１及び第２撮像手段の出力する画像情報の輝度重複部分で、輝度に関して連続的に変化する重み関数を用いて合成を行い、かつ、当該重み関数は、前記ストロボ到達領域識別手段で識別された結果に応じて、形若しくはパラメータが変わることを特徴とする。これにより、ストロボ使用時にもダイナミックレンジの広い画像を得ることができる。

【００２１】また、好ましい態様によれば、ストロボと、ストロボの使用状態を選択する第４選択手段とをさらに有し、前記制御手段が、ストロボ使用時に、自動的に前記第１撮像素子の蓄積時間と第２撮像素子の蓄積時間とが等しくなるように当該第１及び第２撮像素子を制御し、前記合成手段が、前記第１及び第２撮像手段の出力する画像情報を強度的に加算することにより合成を行うことを特徴とする。これにより、Ｓ／Ｎ比を向上させて画質を良くすることができる。

【００２２】また、好ましい態様によれば、前記合成手段が、前記制御手段を構成する中央演算処理装置によるソフトウエア処理により合成処理を行うことを特徴とする。

【００２３】また、好ましい態様によれば、前記第１及び第２撮像手段が、ともに単体でフルカラー画像を取り込むことが可能なカラー撮像手段であることを特徴とする。

【００２４】また、好ましい態様によれば、前記カラー撮像手段が、オンチップカラーフィルタを有し、画素は相対的に同じ空間に配置されるが、オンチップカラーフィルタの色は相対的にずれた空間位置に配置されることを特徴とする。

【００２５】また、好ましい態様によれば、前記第１選択手段が前記自動モードを選択している場合において、前記被写体輝度範囲が所定値よりも狭い場合と広い場合とで、前記合成手段による合成のアルゴリズムを切り替えることを特徴とする。

【００２６】また、好ましい態様によれば、前記合成手段が、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合において、前記第２選択手段によって選択されたダイナミックレンジの広さに応じて、前記合成手段による合成のアルゴリズムを切り替えることを特徴とする。

【００２７】また、好ましい態様によれば、前記第１及び第２撮像手段は、ともに単体でフルカラー画像を取り込むことが可能なカラー撮像手段であり、前記第１選択手段が前記自動モードを選択している場合において、前記被写体輝度範囲が狭い場合は、前記合成手段が、偽色防止と解像度向上を優先したアルゴリズムを用いて画像合成を行い、前記被写体輝度範囲が広い場合は、前記合成手段が、ダイナミックレンジ拡大を優先したアルゴリズムを用いて画像合成を行うことを特徴とする。

【００２８】また、好ましい態様によれば、前記第１及び第２撮像手段が、ともに単体でフルカラー画像を取り込むことが可能なカラー撮像手段であり、撮影画像のダイナミックレンジを撮影者が手動で所望の範囲に設定する場合において、前記第２選択手段によって狭いダイナミックレンジが選択されている場合は、前記合成手段が、偽色防止と解像度向上を優先したアルゴリズムを用いて画像合成を行い、前記第２の選択手段によって広いダイナミックレンジが選択されている場合は、前記合成手段が、ダイナミックレンジ拡大を優先したアルゴリズムを用いて画像合成を行うことを特徴とする。これにより、第１及び第２撮像手段の出力する画像を合成する際の境界での不連続を少なくすることができる。

【００２９】

【発明の内容の説明】以下、本発明の基本的な原理について簡単に説明する。

【００３０】本発明の画像取り込み装置では、２つの撮像手段（第１及び第２撮像素子）を使用し、かつ、それらの蓄積時間の比を可変にすることにより、被写体の輝度差に応じた良好な画像や、撮影者の意図に応じた所望の画像を得ることができる。

【００３１】また、２つの撮像素子に光を分割することによる光量低下を防止し、かつ、第１及び第２撮像素子の蓄積時間（露出時間）Ｔ１、Ｔ２の差が極端に大きくならないような範囲で、第２撮像素子への光量配分を小さくし（例えば１／３以下）、第１撮像素子への光量配分を大きく（例えば２／３以上）することが好ましい。この場合、両者における光量分配の比は２倍以上になる。

【００３２】通常の使用状態、すなわちダイナミックレンジを自動的に制御する自動モードを選択した場合、被写体輝度範囲検出手段によって検出された被写体輝度に応じて、自動的に最適な蓄積時間の比（Ｔ１／Ｔ２）をカメラが選択し、輝度範囲の広い画像に対してはダイナミックレンジの広い画像を、輝度範囲の狭い画像に対しては画質のよい画像を撮影する。

【００３３】また、上記のような自動モードでは、撮影者の意図を反映できない場合もあるため、ダイナミックレンジを手動で調節する手動モードも設定可能とする。このような手動モードを選択した場合、更に、広ダイナミックレンジ優先モードか、狭ダイナミックレンジモード（画質優先モード）を選択できるようにする。

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【００３４】広ダイナミックレンジ優先モードでは、画像情報を適宜合成することによって常にダイナミックレンジの広い画像が得られ、黒つぶれや白つぶれの少ない画像を得ることができる。一方、画質優先モードでは、ダイナミックレンジは単板撮像素子の場合と同等となるが、画像情報を適宜合成することによって偽色が少なく解像の良い画像を得ることができる。

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＊【００３５】参考のため、以下に、第１及び第２撮像素子から出力される画像情報を合成するためのアルゴリズムの具体例について説明する。

【００３６】露光条件Ｅｉで撮像した画像の画素（ｘ，ｙ）に対応する出力値をＬｉ（ｘ，ｙ）（ここで、ｉ＝１，２）とすると、ダイナミックレンジが拡大された画像Ｌｗｉｄ（ｘ，ｙ）は、次の如く求める。

```
for  i=1  to  i=2  do
 for  (x, y)=(0, 0)  to  (X−1, Y−1)  do
  if  i=1  then
   Lwid(x, y)=L1(x, y)(E2／E1)γ
  else
   if  L2(x, y)<Lsat
   then  Lwid(x, y)=L2(x, y)
```

ここで、Ｅ２／Ｅ１は、第１及び第２撮像素子の露光量比であり、γはγ補正のパラメータであり、Ｌｓａｔは、第２撮像素子の出力の飽和値である。

【００３７】次に、別のアルゴリズムを応用した合成方法について説明する。上記の方法では、異なる露出条件※で撮像された領域の境界部では、不連続が生じる可能性がある。そのため、輝度の重複領域では、輝度に対して連続的に変化する重み関数を用いて合成する方法が採られる。この場合、画像Ｌｗｉｄ（ｘ，ｙ）は、次の如く求める。

```
for  i=1  to  i=2  do
 for  (x, y)=(0, 0)  to  (X−1, Y−1)  do
  if  i=1  then
   Lwid(x, y)=L1(x, y)(E2／E1)γ
  else
   Lwid(x, y)=f(L2(x, y))L2(x, y)(E2／E1
)γ+{1−f(L2(x, y))}Lwidγ
```

ここで、ｆは画像を合成するときの重み関数である。

【００３８】

【発明の実施の形態】〔第１実施形態〕図１は、第１実施形態に係る画像取り込み装置を説明する図である。この画像取り込み装置は、被写体Ｏの像を撮影するための撮影レンズ３と、撮影レンズ３の直後に配置されて光量を調節する絞り４と、光軸ＡＸ上に配置されて光路を２方向に分割する分割光学系である分光ミラー５と、分光ミラー５により分割された一方の光束側の光軸ＡＸ１上に配置された第１撮像素子１と、分割された他方の光束側の光軸ＡＸ２上に配置された第２撮像素子２と、各撮像素子１、２の出力Ａ１、Ａ２をそれぞれＡＤ変換するＡＤコンバータ２１、２２と、ＡＤコンバータ２１、２２からのＡＤ変換後の出力を合成して出力する合成器６と、各撮像素子１、２や合成器６の動作を制御する制御装置７と、制御装置７の動作状態を撮影者側で設定するための選択手段である切替えスイッチＳＷとを備えている。

【００３９】この画像取り込み装置は、被写体Ｏの像を撮影するための光学系とは別に、被写体Ｏの輝度範囲である被写体輝度範囲を検出する輝度範囲検出部１０をさらに備える。この輝度範囲検出部１０は、被写体Ｏの像を撮影レンズ３とは別に結像する第２レンズ１０ａと、光軸ＡＸにほぼ平行な第２レンズ１０ａの光軸ＡＸ’上に配置されて被写体Ｏの像が投影される多分割ＳＰＤ（シリコン・フォトダイオード）１０ｂと、この多分割ＳＰＤ１０ｂを構成する各素子に並列に接続される１ｏｇアンプ１０ｃとを含む。これは、銀塩カメラの露光量検出用のマルチ測光センサーと同様の構造であり、検出範囲は広く、一度の測光で被写体の輝度範囲を計測できる。この輝度範囲検出部１０からの出力（すなわち被写体輝度範囲）をもとに、各撮像素子１、２における蓄積時間（露光時間）や絞り４の絞値を決定することができ、合成器６のおける合成処理に必要なパラメータ等の設定に用いることができる。

【００４０】制御装置７は、画像取り込み装置の動作を統括的に制御するもので、輝度範囲検出部１０の出力や切替えスイッチＳＷの設定に基づいて合成器６の動作を制御する等の働きを有するＣＰＵ７３（中央演算処理装置）と、このＣＰＵ７３からの指示に応じて両撮像素子１、２による撮像に際しての蓄積時間を制御するタイミング発生器７４とを備える。

【００４１】制御装置７による制御下で合成器６から出力された合成後の画像情報である出力Ｖは、画像処理装置８に入力されて各種信号処理や圧縮処理が施される。画像処理装置８からの画像処理後のデータは、記憶装置９に入力されてここに保存される。なお、制御装置７は、合成器６のみならず、画像処理装置８及び記憶装置

９の動作も制御しており、レリーズ動作の指示に基づいて各撮像素子１、２に適当なタイミングで必要な画像を取り込ませるとともに、これに適当な合成等の処理を施し、得られた画像を適宜保存する。

【００４２】図２は、切替えスイッチＳＷの具体例を説明する図である。図示の切替えスイッチＳＷは、撮影画像のダイナミックレンジを自動モード若しくは手動モードのいずれで設定するかの選択と、手動モードにおいて広ダイナミックレンジ優先又は画質優先のいずれで撮影するかの選択とを行うためのものである。なお、前者の自動モードは、調節する撮影画像のダイナミックレンジを自動的に所定の範囲に設定する動作モードであり、後者の手動モードは、撮影者が手動で所望の範囲に設定する動作モードである。

【００４３】図２（ａ）は、ダイナミックレンジを自動モード又は手動モードのいずれにするかの選択を行う第１選択手段であるスイッチＳＷ１と、手動モードにおいて撮影モードを広ダイナミックレンジ優先、画質優先、それらの中間のいずれにするかの選択を行う第２選択手段であるスイッチＳＷ２とを別々に設けた例である。図２（ｂ）は、自動モード又は手動モードのいずれにするかの選択と、手動モードにおいて撮影モードを広ダイナミックレンジ優先、画質優先及びそれらの中間のいずれにするかの選択とをひとまとめにしたスイッチＳＷ１２の例である。図２（ｃ）は、液晶表示器ＬＣＤの画面に表示されるメニューを見ながら、自動モード又は手動モードのいずれにするかの選択と、手動モードにおいて撮影モードを広ダイナミックレンジ優先、画質優先及びそれらの中間のいずれにするかの選択とを一対のコマンドボタンＳＷ３で選択する例である。

【００４４】図２に示すような切替えスイッチＳＷによってダイナミックレンジ自動モードが設定されている場合、手動モードに関する切換スイッチＳＷの設定は無効になる。自動モードが設定された状態で画像取り込み装置がレリーズされると、図１に示す輝度範囲検出部１０によって検出された被写体輝度範囲に応じて、自動的に最適な蓄積時間の値と比（Ｔ１／Ｔ２）をカメラが選択し、輝度範囲の広い画像に対してはダイナミックレンジの広い画像を、輝度範囲の狭い画像に対しては画質の良い画像を撮影する。

【００４５】一方、図２に示す切替えスイッチＳＷによってダイナミックレンジ手動モードが選択されている場合、更に、撮影モードの切替えスイッチＳＷにより、広ダイナミックレンジ優先モード、画質優先モード、又はその中間のモードの選択が可能となる。この時、被写体輝度範囲検出部１０は、画像取り込み装置の露出を決定するためのＡＥセンサーとして動作する。ここで、広ダイナミックレンジ優先モードが選択された場合、常にダイナミックレンジの広い画像が得られ、黒つぶれや白つぶれの少ない画像を得ることができる。一方、画質優先モードでは、ダイナミックレンジは撮像素子単板の場合と同等だが、画質の良い画像を得ることができる。

【００４６】以下、図１の装置の動作について説明する。撮影レンズ３を通った光は、分光ミラー５によって分割されて、第１撮像素子１と第２撮像素子２とにそれぞれ投影される。この時、第１撮像素子１に供給される光量の割合ｒ１と第２撮像素子２に供給される光量の割合ｒ２とは、ｒ１＞ｒ２なる関係を有し、分割比ｒ１／ｒ２は、２から２０の範囲内のある固定した値とする。さらに、分割比ｒ１／ｒ２は、４から１０の範囲内のある固定した値とすることが好ましい。なお、分光ミラー５は、例えば透過率と反射率の割合が元から異なる光学素子としても良いし、あるいは透過率と反射率が同じハーフミラーを用いて５０％と５０％で２分割し、一方に関しＮＤフィフィルターで光量を必要量だけ減衰させてもよい。ただし、好ましくは、ＮＤフィルタを使用せず、単一の分光ミラー５とした方が、光量損失が無く効率が良い。

【００４７】画像取り込みの指示があった場合、図示の画像取り込み装置はレリーズ動作を行う。具体的には、制御装置７が、絞り駆動装置（図示を省略）により絞り４を駆動して最適な照明光量に設定する。次に、制御装置７は、第１及び第２撮像素子１、２を動作させて投影した画像を光電変換することによって得た画像信号を出力する露出を行う。この際、制御装置７は、タイミング発生器７４を介して第１及び第２撮像素子１、２の蓄積時間Ｔ１、Ｔ２をそれぞれ独立に制御してこれらを最適な値に制御することができる。第１及び第２撮像素子１、２の出力は、デジタルデータ処理のためＡＤ変換された後、合成器６によって輝度の合成が行われる。この後、画像処理装置８によって各種信号処理や圧縮が行われ、記憶装置９によって画像処理後の画像データの保存が行われる。なお、通常は撮影に先立ち合焦装置（図示を省略）または手動により、撮影レンズ３の位置を調整して被写体Ｏの像を第１及び第２撮像素子上に合焦させる動作が行われるが、説明は省略している。

【００４８】ここで、第１及び第２撮像素子１、２について行う蓄積時間の比の設定について説明する。自動モードが選択されている場合においては、輝度範囲検出部１０で検出した被写体輝度範囲（この場合、被写体Ｏの輝度差）に応じて、適切なダイナミックレンジの合成画像が得られるように、第１及び第２撮像素子１、２について行う蓄積時間の比を設定する。一方、手動モードが選択されている場合においては、広ダイナミックレンジ優先モード、画質優先モード、及び中間モードのうちいずれが設定されたかに応じて、撮影者の意図する合成画像が得られるように、第１及び第２撮像素子１、２について行う蓄積時間の比を設定する。第１及び第２撮像素子１、２における蓄積時間Ｔ１、Ｔ２の比（Ｔ１／Ｔ２）を設定値に応じて適宜変更すると、露光量の比Ｒ

は、（ｒ１×Ｔ１）／（ｒ２×Ｔ２）で与えられる。

【００４９】図３～図５は、露光量の比Ｒを考慮した上で、合成器６で輝度合成を行う場合の具体的手法を説明する図である。

【００５０】図３は、ダイナミックレンジについて自動モードに設定されていて被写体の輝度差が大きい場合、若しくは、ダイナミックレンジについて手動モードに設定されていて広ダイナミックレンジ優先モードを選択した場合の合成を説明するグラフである。図３（ａ）は合成前の輝度出力を示し、図３（ｂ）は合成の際に用いる重み関数を示し、図３（ｃ）は合成後の輝度出力を示す。なお、図３（ａ）において、横軸は被写体Ｏの輝度を示し、縦軸は両撮像素子１、２の出力Ａ１、Ａ２を示す。図３（ｂ）において、縦軸は両撮像素子１、２の出力値Ａ１、Ａ２を合成するための重み関数の値を示し、図３（ｃ）において、縦軸は合成器６の出力Ｖを示す。この場合は、蓄積時間Ｔ１、Ｔ２の比を大きくし、２つの撮像素子１、２の光電変換特性の直線部分のオーバーラップ領域を小さくし、広い輝度範囲の情報を取り込めるようにしている。被写体Ｏの輝度範囲が広い場合、上記のような合成によって広いダイナミックレンジを確保する。

【００５１】図４は、自動モードで被写体の輝度差が中程度の場合、若しくは、手動モードで中間のモードを選択した場合の合成を説明するグラフである。図４（ａ）は合成前の輝度出力を示し、図４（ｂ）は合成の際に用いる重み関数を示し、図４（ｃ）は合成後の輝度出力を示す。この場合は、蓄積時間Ｔ１、Ｔ２の比を小さくし、２つの撮像素子１、２による光電変換特性の直線部分の重なりが大きくなるようにする。直線部分の重なる領域が大きければ、合成時に不連続が生じる現象を効果的に防ぐことができる。図示のような合成によって、広いダイナミックレンジを確保するとともに合成のつなぎ目で不連続が生じにくいものとすることができる（画質とＤＲ優先）。なお、直線部分の重なる領域が大きければ、合成時に不連続が生じる現象を効果的に防ぐことができる。

【００５２】図５は、自動モードで被写体の輝度差が小さい場合、若しくは、手動モードで画質優先モードを選択した場合の合成を説明するグラフである。図５（ａ）は合成前の輝度を示し、図５（ｂ）は合成の際の重み関数を示し、図５（ｃ）は合成後の輝度を示す。この場合は、蓄積時間Ｔ１、Ｔ２を等しくし、あるいはＴ１よりもＴ２の方をかえって長くする（Ｔ１＜Ｔ２）ことにより、露光量比Ｒ、すなわち（ｒ１×Ｔ１）対（ｒ２×Ｔ２）の比をほぼ１に近くする、あるいは１に等しくする。また重み関数も単純に１とし、２つの撮像素子の出力を単純に加算する。結果、合成による不連続は生じないし、ランダムノイズは打ち消し合う方向に働くので、画質は良くなる（画質優先）。

【００５３】なお、合成器６に重み関数をＬＵＴ（ルックアップテーブル）として持たせることにより、高速の合成処理が可能になる。この場合、合成器６に輝度差や手動モード時の設定に応じた複数のＬＵＴを用意しておき、それらを必要に応じて切り替えて合成を行う。

【００５４】また、ＬＵＴを使わず、合成器６を構成する回路中に乗算回路と加算回路からなる演算回路を組み込むこともできる。この場合、蓄積時間Ｔ１、Ｔ２の比に応じて重み関数のパラメーターを変えることによって、合成処理を行うことも可能である。

【００５５】また、特別に合成処理を行う合成回路を持たず、代わりにＣＰＵ７３の演算機能を用いてソフトウエアによる処理で合成を行うことも可能である。

【００５６】また、第１及び第２撮像素子１、２としてＣＣＤを用いる場合、第２撮像素子２（分割光学系で反射された鏡像を撮像する撮像素子）としては、例えば鏡像モード付き、または鏡像専用のＣＣＤを用いることが考えられる。このようなＣＣＤを用いれば、図１に示すような分割ミラーを用いて片方だけが鏡像になる場合であっても、同じ空間位置の画素出力を同じタイミングで読み出すことが可能である。または、フレームメモリーを装備し、通常のＣＣＤを用いて読み出した情報を前述のフレームメモリーに記録し、鏡像を補正する順番に情報を読み出して画像合成する構成とすることも可能である。

【００５７】〔第２実施形態〕図６は、第２実施形態に係る画像取り込み装置の構造を説明する図である。この画像取り込み装置は、第１実施形態の装置の変形例であり、同一部分には同一の符号を付して重複説明を省略する。本実施形態の装置は、露光タイミングのモードを切り替えるための第３選択手段として切替えスイッチＴＳＷを備えており、ＣＰＵ７３は、切替えスイッチＴＳＷによる設定に基づいて第１及び第２撮像素子１、２からの画像信号を合成器６へ転送するタイミングを制御する。さらに、この装置は、第１及び第２撮像素子１、２からの画像信号をそれぞれ一時的に保存する一対のフレームメモリー１２１、１２２を備える。

【００５８】図７は、露光タイミング用の切替えスイッチＴＳＷの具体例を示す図である。図７（ａ）は、露光タイミングのモード設定のために専用のスイッチＴＳＷ１を設けた例であり、図７（ｂ）は、液晶表示器ＬＣＤの画面に表示されるメニューを見ながら、露光タイミングをいずれのモードに設定するかを一対のコマンドボタンＴＳＷ３で選択する例である。なお、図示の例では、露光タイミングのモードは、終了一致、開始一致、及びブレ最小の３通りに設定可能となっている。

【００５９】図８から図１０は、第１及び第２撮像素子１、２の露光タイミングを説明する図である。この実施形態では、第１及び第２撮像素子１、２による蓄積のタイミングを、蓄積時間Ｔ１、Ｔ２の中央時刻の差が所定

値以下になるようにする第１のモードと、蓄積開始時刻を一致させる第２のモードと、蓄積終了時刻を一致させる第３のモードとの３段階で制御する。撮影者は、これら３つのモードから所望のモードを選択してその意図に沿った撮影を行うことができる。

【００６０】図８は、切替えスイッチＴＳＷによって上記第１のモードが選択された場合に対応し、ブレを最小とする標準の露光タイミングを説明する図である。図８（ａ）は第１撮像素子１の露光タイミング（蓄積タイミング）と信号読出タイミングとを示し、図８（ｂ）は第２撮像素子２の露光タイミング（蓄積タイミング）と信号読出タイミングとを示す。第１モードの露光タイミングでは、図からも明らかなように、第１及び第２撮像素子１、２の蓄積時間Ｔ１、Ｔ２の中央時刻の差が所定時間以内になるように制御する。この所定時間をいくつに設定するかは任意であるが、およそ１／１０秒から１／１００秒程度の範囲に設定するのが好ましい。通常、撮影レンズ３の焦点距離が短い場合は、ブレが目立ちにくいので、上記所定時間（中央時刻の差）は多少長くてもよいが、撮影レンズ３の焦点距離が長い場合は、ブレが目立ちやすいので、上記所定時間は短く設定することが好ましい。このような制御方法を行うことにより、ブレの目立ちにくい画像を得ることができる。

【００６１】図９及び図１０は、切替えスイッチＴＳＷによって上記第２もしくは第３のモードが選択された場合に対応し、両撮像素子１、２による露出開始や露光終了を一致させる場合を説明する図である。図９は、露光開始を一致させる露光タイミングを説明する図であり、図９（ａ）は第１撮像素子１の露光タイミングと信号読出タイミングとを示し、図９（ｂ）は第２撮像素子２の露光タイミングと信号読出タイミングとを示す。一方、図１０は、露光終了を一致させる別の露光タイミングを説明する図であり、図１０（ａ）は第１撮像素子１の露光タイミングと信号読出タイミングとを示し、図１０（ｂ）は第２撮像素子２の露光タイミングと信号読出タイミングとを示す。

【００６２】図９の場合は、ちょうど通常の一眼レフカメラでストロボを使用して後幕シンクロ撮影（シャッターが閉じる直前にストロボを発光するモード）をした時と似た効果を生むことができ、図１０の場合は、先幕シンクロ撮影（シャッターが開いた直後にストロボを発光するモード）をした時と似た効果を生むことができる。

【００６３】ここで、図８や図９に示すように、蓄積時間Ｔ１、Ｔ２の露光終了時刻が異なる場合（蓄積時間Ｔ２の方が先に露光終了とする）、仮に同時に画像を出力しようとすると、第２撮像素子２の露光が終わってから、第１撮像素子１の露光が終わるまで時間間隔が空くことになる。第１及び第２撮像素子１、２としてＣＣＤを用いる場合を考えると、その間、第２撮像素子２の信号電荷は垂直転送ＣＣＤの中で保持されることになる。垂直転送ＣＣＤは一般にフォトダイオードに比べて暗電流の影響が大きい。この結果、暗電流成分によるノイズの影響が大きくなる。そのため、この実施形態では、第１及び第２撮像素子１、２による露光終了の時刻差が大きいか否かに拘わらず、第２撮像素子２の露光が終わった時点でここから画像信号を読み出してフレームメモリー１２２に一時的に保存する。次に、第１撮像素子１の露光が終わった時点でここから画像信号を読み出してフレームメモリー１２１に保存する。その後、両フレームメモリー１２１、１２２に記憶した第１及び第２撮像素子１、２を同時に読み出し、読み出した画像信号を合成器６で合成処理する。この結果、暗電流の影響を受けにくくなる。

【００６４】〔第３実施形態〕図１１は、第３実施形態に係る画像取り込み装置の構造を説明する図である。この画像取り込み装置は、第２実施形態の装置の変形例であり、同一部分には同一の符号を付して重複説明を省略する。本実施形態の装置は、内蔵ストロボＦＬ１、若しくは脱着可能な外付けストロボＦＬ２を接続するためのコネクタＣＮＮを具備している。また、ストロボＦＬ１、ＦＬ２の使用状態を、例えば強制発光、自動発光、発光禁止のストロボモード中から選択する選択スイッチＳＳＷも具備している。

【００６５】選択スイッチＳＳＷで強制発光モードが選択された場合、または、自動発光モードでカメラがストロボ必要と判断した場合は、ストロボが発光する。この時、発行ストロボＦＬ１、ＦＬ２の動作タイミングは、第２実施形態で述べた露光タイミング用の切替えスイッチＴＳＷと連動する。すなわち、図８～図１０に示す露光タイミングにおいて、第１及び第２撮像素子１、２の両方が露光している期間中に、これらの露光に同期させてストロボＦＬ１、ＦＬ２を発光させる。

【００６６】ところで、ストロボＦＬ１、ＦＬ２からの照明光（ストロボ光）が届かない領域では、第１実施形態で説明したように、第１及び第２撮像素子１、２の露光量比は、（ｒ１×Ｔ１／ｒ２×Ｔ２）となる。これに対し、ストロボ光のみで露光する領域では、通常ストロボの発光時間は両蓄積時間Ｔ１、Ｔ２よりも短いため、第１及び第２撮像素子１、２の露光量比は単純に（ｒ１／ｒ２）となる。ストロボ光と自然光の両方が露光に寄与する領域では、露光量比は（ｒ１×Ｔ１／ｒ２×Ｔ２）と（ｒ１／ｒ２）の中間の値となる。このため、単純に輝度の合成をしたのでは不具合が生じ得る。

【００６７】そのため、本実施形態の装置は、画像内でストロボ光の到達する領域を検出して識別する識別手段を備える。このような識別手段の実現方法として、例えば、本撮影の直前にストロボＦＬ１、ＦＬ２をプリ発光させ、第１及び第２撮像素子１、２等によって画像を取り込み、取り込んだ画面の輝度からこの画面内でストロボＦＬ１、ＦＬ２の到達する領域を識別することととす

る。その後、本撮影を行う際に、前述の識別手段によるストロボ到達領域の識別結果を参照し、かつ、実際の撮影によって得られた画像の各点の輝度差も参照して、合成の重みづけ関数の形やパラメータを調整しながら合成を行う。この様にすることにより、ストロボＦＬ１、ＦＬ２使用時にも、ダイナミックレンジの広い画像を得ることができる。

【００６８】別の制御方法として、ダイナミックレンジモードや画質モードに関わりなく、ストロボＦＬ１、ＦＬ２の使用時は常に第１及び第２撮像素子１、２の露光時間を等しく設定することもできる。すなわち、ストロボ使用時はＴ１＝Ｔ２に固定する。このようにすると、２つの撮像素子１、２の露光量比は、ストロボ光の届くか否かに関わらず、常に（ｒ１／ｒ２）となる。この場合は、ストロボ光の到達する領域を識別する前述のような識別手段は不要となる。撮像した画像を合成することにより、２つの撮像素子１、２からの画像信号のノイズ成分は平均化されるので、Ｓ／Ｎが上がり画像が良くなる。

【００６９】〔第４実施形態〕図１２は、第４実施形態に係る画像取り込み装置の構造を説明する図である。

【００７０】この画像読み取り装置は、第１実施形態の装置の変形例であり、撮影レンズ３を利用して被写体輝度範囲を検出する輝度範囲検出部１１０を備えている。さらに、この装置は、第１及び第２撮像素子１、２からの画像信号をそれぞれ一時的に保存する一対のフレームメモリー１２１、１２２を備える。

【００７１】輝度範囲検出部１１０は、光軸ＡＸ上に配置されて像光の一部を反射するミラー１１０ａと、ミラー１１０ａで反ささされた光を集光する第２レンズ１０ａと、第２レンズ１０ａを通過した光が投影される多分割ＳＰＤ１０ｂと、多分割ＳＰＤ１０ｂの素子に個別に接続される１ｏｇアンプ１０ｃとを備えている。

【００７２】この輝度範囲検出部１１０は、画像取り込み装置の露出時間を決めるためのＡＥセンサーとしての働きも有している。この輝度範囲検出部１１０からの素子出力をもとに、各撮像素子１、２の露光時間や絞り４の絞値を決定する。

【００７３】なお、ダイナミックレンジについて切替えスイッチＳＷにて手動モードを選択している場合は、輝度範囲検出部１１０から得られる被写体輝度範囲に関する情報は不要である。したがって、輝度範囲検出部１１０から得られる情報のうち被写体輝度範囲についての情報は用いず、輝度範囲検出部１１０を画像読み取り装置の露出センサー（ＡＥセンサー）としてのみ用いる。

【００７４】さらに、第１及び第２撮像素子１、２は、撮像（画像取り込み）専用として用いる必要はなく、焦点検出（ＡＦ）手段等として活用することもできる。例えばＣＣＤＡＦ（山登りＡＦ等）を行う場合や、液晶ファインダーを表示させる場合は、両撮像素子１、２のうちの片方のみを動作させて制御装置７に必要な処理を行わせることができる。どちらの撮像素子１、２を用いるかは、その時の被写体の輝度に応じて切り替えることもできる。この場合は、合成器６も機能させず、単に撮像素子１、２のうち、動作しているどちらか一方の出力をそのまま素通りさせる。この結果、消費電力を減らすことが可能である。

【００７５】〔第５実施形態〕図１３は、第５実施形態に係る画像取り込み装置を説明する図である。この画像読み取り装置は、画像取り込み用の撮像素子（ＣＣＤ）１、２自体を利用して輝度範囲検出を行う。

【００７６】以下、本実施形態の装置の動作を説明する。まず、第１及び第２撮像素子１、２により十分異なる蓄積時間で被写体輝度検出用の撮像動作を行う（例えばＴ１／Ｔ２が１０倍以上）。次に、それぞれの撮像素子１、２の出力のヒストグラムを調べ、検出された輝度範囲の上限値及び下限値を求める。以上の動作を繰返して蓄積時間の最適化を行う。

【００７７】図１４（ａ）は、被写体の現実の輝度範囲の分布を示し、図１４（ｂ）は、両撮像素子１、２で検出可能な被写体輝度範囲の変更例を示す。図１４（ｂ）に示す第１段階の時刻（Ａ）の状態では、現在検出されている輝度範囲よりも更に高輝度の領域が被写体中に存在している。両撮像素子１、２による検出結果をフィードバックするべく比Ｔ１／Ｔ２を保ったまま両蓄積時間Ｔ１、Ｔ２の値を所定量だけ増加し、再びヒストグラムを調べて輝度範囲の上限値及び下限値を求める（第２段階の時刻（Ｂ）の状態）。このような動作を繰り返し、被写体の輝度範囲（ＭＡＸ，ＭＩＮ）を検出する（第３段階の時刻（Ｃ）の状態参照）。なお、これらの動作中は、両撮像素子１、２を構成するＣＣＤから全画素を読み出すのでなく、ＣＣＤの画素を間引きして読出す動作としてもよい。レリーズ動作時には、ダイナミックレンジについて切替えスイッチＳＷにて自動モードを選択している場合、最適な蓄積時間Ｔ１、Ｔ２を選び、切替えスイッチＳＷにて手動モードを選択している場合、選択された撮影モードに従って蓄積時間Ｔ１、Ｔ２を決定し、静止画の撮影を行う。つまり、自動モードが選択されている場合、検出した被写体輝度範囲（ＭＡＸ，ＭＩＮ）及び、被写体輝度のヒストグラムや、輝度の分布に応じて、両撮像素子１、２の蓄積時間Ｔ１、Ｔ２及びその比Ｔ１／Ｔ２の最適値を求め、レリーズ動作時には、得られた最適な蓄積時間Ｔ１、Ｔ２で静止画の撮影を行う。

【００７８】〔第６実施形態〕図１５は、第６実施形態に係る画像取り込み装置を説明する図である。

【００７９】この画像読み取り装置は、画像取り込み用の撮像素子として、カラー型のＣＣＤからなる撮像素子１０１、１０２を用いている。また、両撮像素子１０１、１０２からの画像信号を合成するため合成器２０６

は補間機能も備えている。

【００８０】２つの撮像素子（ＣＣＤ）１０１、１０２を構成する画素は、相対的に同じ位置となっている。すなわち、画素を１／２ピッチずらす、いわゆる画素ずらしと呼ばれる手法は用いない。両撮像素子１０１、１０２上に設けたオンチップ型の色フィルタ１０１ａ、１０２ａの配置は、相対的に同じ位置とすることもできるし、配置は相対的にずれた位置とすることもできる。

【００８１】図１６～図１８は、色フィルタ１０１ａ、１０２ａの配置例を概念的に説明する図である。図１６は、ＲＧＢを全て相対的に同じ位置に配置した例であり、図１６（ａ）は色フィルタ１０１ａの配置を示し、図１６（ｂ）は色フィルタ１０２ａの配置を示す。図１７は、Ｇを同じ位置、ＲＢを相補的な位置に配置した例であり、図１７（ａ）は色フィルタ１０１ａの配置を示し、図１７（ｂ）は色フィルタ１０２ａの配置を示す。図１８は、ＲＧＢを全て相対的にずれた位置に配置した例であり、図１８（ａ）は色フィルタ１０１ａの配置を示し、図１８（ｂ）は色フィルタ１０２ａの配置を示す。

【００８２】なお、いずれの場合もベイヤー配列の撮像素子１、２を組み合わせて画像取り込みを実現している場合を示すが、別のカラーフィルタ配置や補色フィルター配置でもよい。

【００８３】例えば図１８に示すように、ベイヤー配列の撮像素子を２つ組み合わせて色フィルタの相対的位置をずらして使用する場合、Ｇは全画素で情報が得られ、ＲとＢは２画素に１画素の割合で情報が得られる。

【００８４】以下、２つの撮像素子１、２から得られた露光量の異なるカラー画像情報の合成について説明する。

【００８５】図１６に示すようにＲＧＢを全て相対的に同じ位置に配置した場合の合成は、これまでの実施形態で説明したと同様に、単純に対応画素を適当な重み関数で重ね合わせるだけで足りる。図１７や図１８に示すようにＲＧＢの少なくとも１つについて相対的位置ずれがある場合、合成や補間に際して工夫が必要となる。

【００８６】具体的には、まず各色ごとに空間的に隣接する画素出力を用いてＲＧＢ各成分の階調の合成を行い（例えば図１８に示す配置の場合、Ｒ１１とｒ２１を合成し、Ｇ２１とｇ３１を合成し、Ｇ１２とｇ２２を合成し、Ｂ２２とｂ３２を合成する）、このようにして得られた合成後の値からＲＧＢの補間を行ってフルカラーの画像を生成することができる（第１の方法）。或いは、最初に両方の画像それぞれについてＲＧＢ補間を行い、それから各画素についてＲＧＢ各成分の階調の合成を行ってもよい（第２の方法）。或いは、最初に一方の第２撮像素子２の各画素について、第１撮像素子１の対応する画素の色成分の補間を行って（例えば図１８に示す配置の場合、第２撮像素子２のｒ’１１、ｇ’２１、ｇ’１２、ｂ’２２を周囲の画素から補間して生成し）、補間後の対応する位置について他方の第１撮像素子１との間でＲＧＢ各成分の階調の合成を行い（例えば図１８に示す配置の場合、Ｒ１１とｒ’１１を合成し、Ｇ２１とｇ’２１を合成し、Ｇ１２とｇ’１２を合成し、Ｂ２２とｂ’２２を合成し）、最後に再びＲＧＢ補間をすることもできる（第３の方法）。

【００８７】なお、第１番目の方法のように最初に各色について空間的に隣接する画素を用いてＲＧＢ各色の階調合成処理を行い、その後でＲＧＢ補間処理を行ったほうが計算量が少なくなる。逆に、第２番目の方法のように先に補間処理を行ってから階調合成処理を行う場合は、必要とされる計算量やメモリーは多くなるが、偽色や解像に関しては有利になる。第３番目の方法のように一方の画像の補間、階調の合成、合成した画像の補間を行う方法は、これらの中間的な特徴を持つ。

【００８８】本実施形態（図１８に示す配置の場合）において、特に被写体の輝度範囲が狭い場合は、Ｔ１≒Ｔ２あるいは、Ｔ１＜Ｔ２とすることにより、２つの撮像素子の露光量をほぼ等しくすることが可能である。この場合は、全画素についてＧの情報、また２画素に１画素の割合でＲ及びＢの情報を得ることができるので、２つの撮像素子１、２のゲイン調整、及びＲＢの補間処理することにより偽色が少なく解像の高い良好な画像を得ることができる。

【００８９】これらのことにより、ダイナミックレンジ自動モードで被写体の輝度差が大きい場合、及びダイナミックレンジ手動モードで広ダイナミックレンジ優先モードを選択した場合は、ダイナミックレンジの広いカラー画像得ることができる。一方、ダイナミックレンジ自動モードで被写体の輝度差が小さい場合、及びダイナミックレンジ手動モードで画質優先モードを選択した場合は、被写体の輝度差が小さい場合は偽色が少なく解像の高い良好な画像を得ることができる。

【００９０】また第３実施形態の変形例で示したように、ストロボＦＬ１、ＦＬ２を設けてストロボＦＬ１、ＦＬ２の使用時は２つの撮像素子１、２の露光時間が等しくなるように制御を行い、画質を優先させた画像を得ることができる。

【００９１】なお、以上では、各実施形態に関して個別に説明したが、これらを任意に組み合わせることが可能なことは言うまでもない。例えば、内蔵ストロボＦＬ１を備え、４つの選択スイッチ（ダイナミックレンジモード切替え用のスイッチＳＷ１、撮影モード切替え用のスイッチＳＷ２、タイミングモード切替え用のスイッチＴＳＷ、ストロボモード切替え用のスイッチＳＳＷ）を持ち、それぞれ切り替え可能とし、被写体輝度検出部１０として、多分割ＳＰＤ素子を備えるものを使用し、画像の合成はＣＰＵ７３によるソフト処理とし、撮像素子１、２はカラーＣＣＤといった組み合わせも可能であ

る。

【００９２】また上記４つの選択スイッチの有無についても種種の組み合わせが可能である。例えば、ダイナミックレンジについてのモードを手動選択専用とし、常に撮影モードの切替え用スイッチで選択する構成も可能である。この場合、ダイナミックレンジの自動・手動のモード切替え用スイッチは不要となり、撮影モードの選択用スイッチが残ることになる。また、別の例としては、ダイナミックレンジについてのモードを自動選択専用とすると、ダイナミックレンジの自動・手動のモードの切替え用スイッチと、撮影モードの切替え用スイッチは不要となる。この場合、タイミングモードの切替え用スイッチとストロボモードの切替え用スイッチとを備える構成となる。さらに、全てのモードを状況に応じて自動で設定するカメラも可能である。この場合は、４つの上記のような選択スイッチ全て不要な構成となる。

【００９３】〔第７実施形態〕図１９は、第７実施形態に係る画像取り込み装置を示し、カメラに適用した例を示す。

【００９４】このカメラ３００は、撮影レンズ３を取付けた筐体３００ａ中に、絞り４と、分割光学系であるビームスプリッタ５と、第１及び第２ＣＣＤ撮像素子１、２と、画像検出合成回路３０６と、制御装置７とを備える。ここで、画像検出合成回路３０６は、図１１に示す第３実施形態の画像取り込み装置も用いて説明するならば、ＡＤコンバータ２１、２２と、フレームメモリー１２１、１２２と、ＡＤ変換後の出力を合成して出力する合成器６とを有している。さらに、筐体３００ａ背面には、モニター用のファインダーとして機能する液晶ディスプレイＬＣＤが取り付けられている。この液晶ディスプレイＬＣＤは、カメラの動作モード（ダイナミックレンジ自動モード、ダイナミックレンジ手動モード、広ダイナミックレンジ優先モード、画質優先モード等）を選択するためにも用いられ、液晶ディスプレイＬＣＤに表示されるメニューを見ながら、コマンドボタンＳＷ３により制御装置７の動作状態を撮影者側で設定することができる。

【００９５】この実施形態では、被写体輝度範囲検出やＡＦ検出をＣＣＤからなる第１及び第２撮像素子１、２自体で行い、液晶ディスプレイ３１０には両撮像素子１、２の出力を輝度合成したものを表示する。これより、ワイドダイナミックレンジの画像を得ることができるカメラを実現できる。また、両撮像素子１、２をカラーＣＣＤとした場合、偽色の少なく解像も良い画像を得ることができるカメラを実現できる。さらに、動画と静止画両方でワイドダイナミックレンジの画像を得ることもできる。或いは、動画撮影時は一方の撮像素子のみの画像情報を用いて普通のビデオカメラと同様に撮影し、静止画の場合のみに両方の撮像素子の画像情報を用いて輝度合成を行い、ワイドダイナミックレンジの静止画を得る構成としてもよい。

【００９６】なお、画像合成等の手法は、第１～第６実施形態で説明したものを適宜組み合わせることで達成できる。ただし、被写体輝度範囲検出及び蓄積時間制御方法としては、図１４等に示すものとほぼ同じ処理を行えば足るが、動画にも対応させるため、被写体輝度範囲の変化に応じてフィードバック制御を行い、変化に追従させる処理を行う必要がある。

【００９７】〔第８実施形態〕図２０は、第８実施形態に係る画像取り込み装置を示し、デジタルスチルカメラに適用した例を示す。

【００９８】このカメラ４００は、本体４００ａと、交換可能なカメラレンズ４００ｂとを備える。カメラレンズ４００ｂは、普通の一眼レフカメラ用の交換レンズであり、一眼レフカメラ用のレンズマウント４００ｃを介して本体４００ａに固定されている。カメラレンズ４００ｂを通過した光は、メインミラー４０１を通過して、フィルム面よりも後側の部分に相当するレンズ４０３、４０４及び固定ミラー４０５からなる縮小用の再結像光学系を介してビームスプリッタ５に導かれる。一方、メインミラー４０１で反射された光は、フォーカシングスクリーン４１０及びペンタプリズム４１１を通過してレンズ４１２を通過した後、光学ファインダ４１３に導かれる。

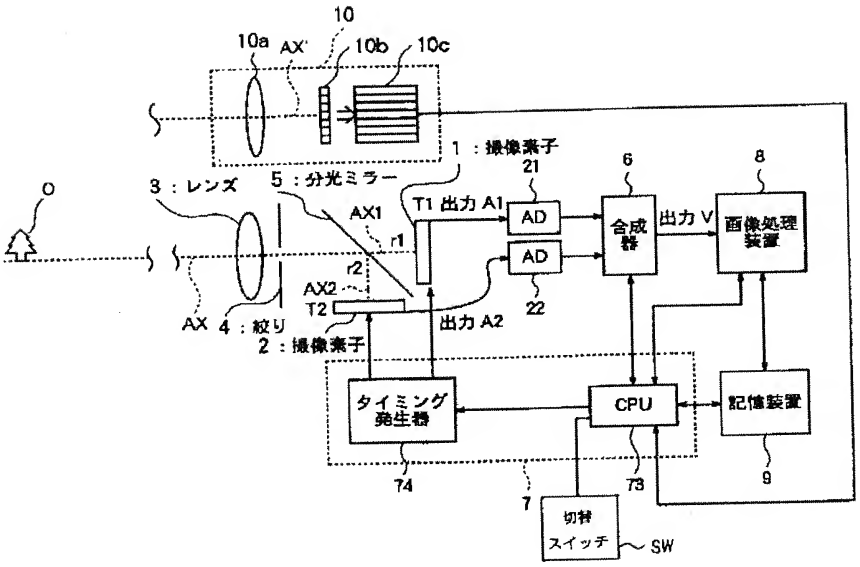
【００９９】なお、メインミラー４０１の裏面側には、サブミラー４２０を配置しており、ＡＦセンサー４２１によって焦点検出を行う。なお、ＡＦセンサー４２１は実施形態のものに限定されない。例えば、別の位置にＡＦ用センサーを配置してもよいし、撮像素子１、２自体でＡＦ検出を行う構成としてもよい。

【０１００】この実施形態では、被写体輝度範囲を検出するため、普通の一眼レフカメラと同じように、ＡＥ用分割センサー４４０を用いている。なお、ＡＥセンサー４４０は実施形態のものに限定されない。例えば、ＣＣＤ撮像素子１、２自体で被写体輝度範囲検出を行う構成としてもよい。ダイナミックレンジに関する自動モード、手動モード等の切り替えは、液晶ディスプレイＬＣＤに表示されるメニューを見ながらボタンで選択する。なお、この液晶ディスプレイＬＣＤは、画像の表示が可能なカラーマトリクス液晶ディスプレイとしても良いし、モードの表示専用の白黒液晶ディスプレイとしても良い。

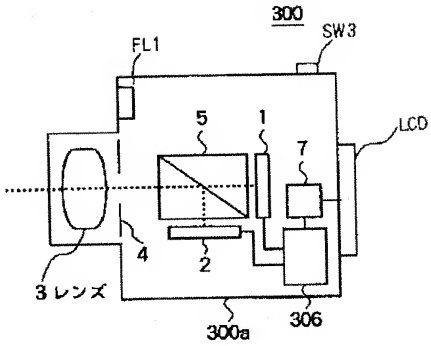
【０１０１】この様な構成により、デジタルスチルカメラ用レンズとして一眼レフカメラ用交換レンズを活用することができるし、第１～第６実施形態に例示した発明を適用することにより、ワイドダイナミックレンジの画像、もしくは偽色が少なく解像の良い画像を得ることができる。しかも、カメラ自体の操作方法は通常の一眼レフカメラと全く同じなので、違和感の無い操作が可能になる。

【０１０２】
【発明の効果】以上の説明から明らかなように、本発明の画像取り込み装置によれば、ダイナミックレンジを自動的に制御する自動モードでは、被写体の輝度差に応じて第１及び第２撮像手段ごとに蓄積時間を設定して適切なダイナミックレンジの画像を取り込むことができ、被写体の輝度差に応じた良好な画像を得ることができる。
【０１０３】また、本発明の別の画像取り込み装置によれば、調整手段で設定された所望の範囲に基づいて第１及び第２撮像手段ごとに蓄積時間を設定することができ、所望のダイナミックレンジを有する画像を取り込むことができる。
【図面の簡単な説明】
【図１】本発明の第１実施形態に係る画像取り込み装置の構成を示すブロック図である。
【図２】（ａ）、（ｂ）、（ｃ）は、ダイナミックレンジモード及び撮影モードの切替えスイッチの例を示す図である。
【図３】（ａ）、（ｂ）、（ｃ）は、図１の装置における被写体輝度範囲が広い場合等の合成を示す図である。
【図４】（ａ）、（ｂ）、（ｃ）は、図１の装置における被写体輝度範囲が中程度場合等の合成を示す図である。
【図５】（ａ）、（ｂ）、（ｃ）は、図１の装置における被写体輝度範囲が狭い場合等の合成を示す図である。
【図６】本発明の第２実施形態に係る画像取り込み装置の構成を示すブロック図である。
【図７】（ａ）、（ｂ）は、画像蓄積タイミングの切換えスイッチの例を示す図である。
【図８】（ａ）、（ｂ）は、図６の装置における、露光の中央時刻の差を所定時間内に収める場合の露光及び読出しタイミングの説明図である。
【図９】（ａ）、（ｂ）は、図６の装置における、露光の開始を合わせる場合の露光及び読出しタイミングの説明図である。
【図１０】（ａ）、（ｂ）は、図６の装置における、露光の終了を合わせる場合の露光及び読出しタイミングの説明図である。
【図１１】本発明の第３実施形態に係る画像取り込み装置の構成を示すブロック図である。
【図１２】本発明の第４実施形態に係る画像取り込み装置の構成を示すブロック図である。
【図１３】本発明の第５実施形態に係る画像取り込み装置の構成を示すブロック図である。
【図１４】図１４の装置における輝度範囲検出動作を示す説明図である。
【図１５】本発明の第７実施形態に係る画像取り込み装置の構成を示すブロック図である。
【図１６】図１５の装置におけるカラーフィルター配置の一例を示す図である。
【図１７】図１５の装置におけるカラーフィルター配置の別の例を示す図である。
【図１８】図１５の装置におけるカラーフィルター配置のさらに別の例を示す図である。
【図１９】本発明の第８実施形態に係るデジタルスチルカメラの構成を説明する図である。
【図２０】本発明の第９実施形態に係るデジタルスチルカメラの構成を説明する図である。
【図２１】従来の画像取り込み装置の構成を示す図である。
【図２２】従来の画像取り込み装置の別の構成を示す図である。
【図２３】輝度の合成方法を説明するための図である。
【符号の説明】
１　第１撮像素子
２　第２撮像素子
３　撮影レンズ
４　絞り
５　分光ミラー
６　合成器
７　制御装置
１０　輝度範囲検出部
２１，２２　変換器
６２　フレームメモリー
７３　ＣＰＵ
８４　欠陥画素補正回路
１０１ａ，１０２ａ　色フィルタ
１１０　輝度範囲検出用素部
４１０　フォーカシングスクリーン
４１１　ペンタプリズム
４１３　光学ファインダ
４４０　ＡＥ用分割センサー
ＬＣＤ　液晶ディスプレイ
ＡＸ　光軸
Ｏ　被写体
ＳＷ，ＳＳＷ，ＴＳＷ　切替えスイッチ
Ｔ１，Ｔ２　蓄積時間
ｒ１，ｒ２　光量分割比

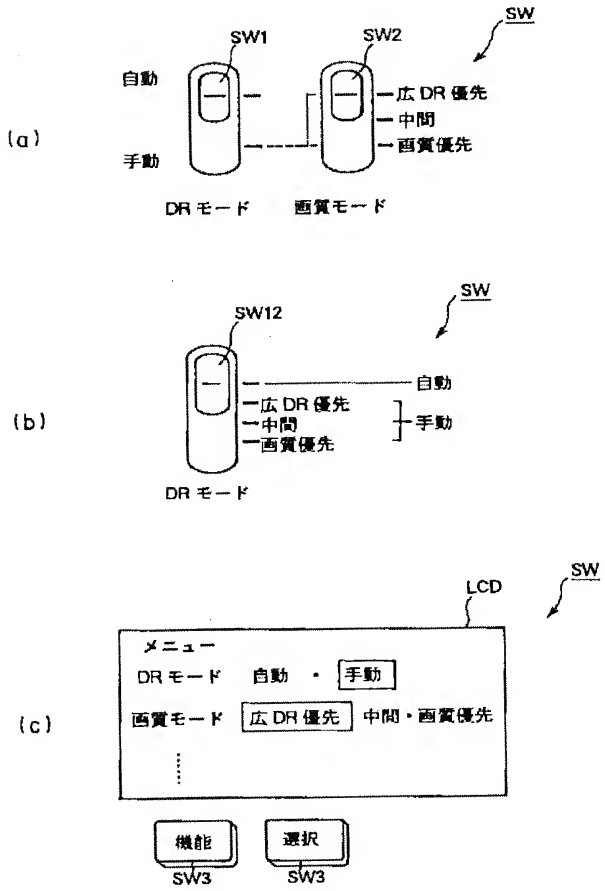
【図１】


10
10a
AX'
10b
10c
1：撮像素子
21
6
8
O
3：レンズ
5：分光ミラー
AX1
T1 出力 A1
AD
合成器
出力 V
画像処理装置
r1
r2
AX2
T2
AD
22
AX
4：絞り
出力 A2
2：撮像素子
タイミング発生器
CPU
記憶装置
74
73
9
7
切替スイッチ
SW

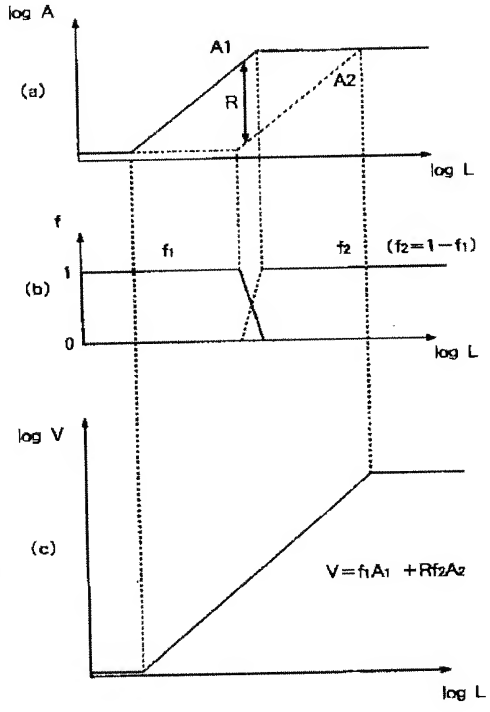
【図１９】


300
SW3
FL1
LCD
5
1
7
4
2
3 レンズ
300a
306

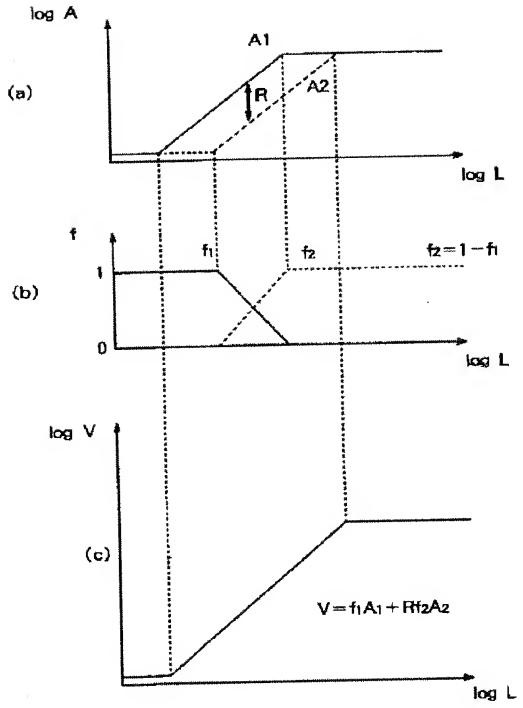
【図２】


(a)
SW
SW1
SW2
自動
手動
広 DR 優先
中間
画質優先
DR モード
画質モード
(b)
SW
SW12
自動
広 DR 優先
中間
画質優先
手動
DR モード
(c)
LCD
SW
メニュー
DR モード　自動　・　手動
画質モード　広 DR 優先　中間・画質優先
機能
SW3
選択
SW3

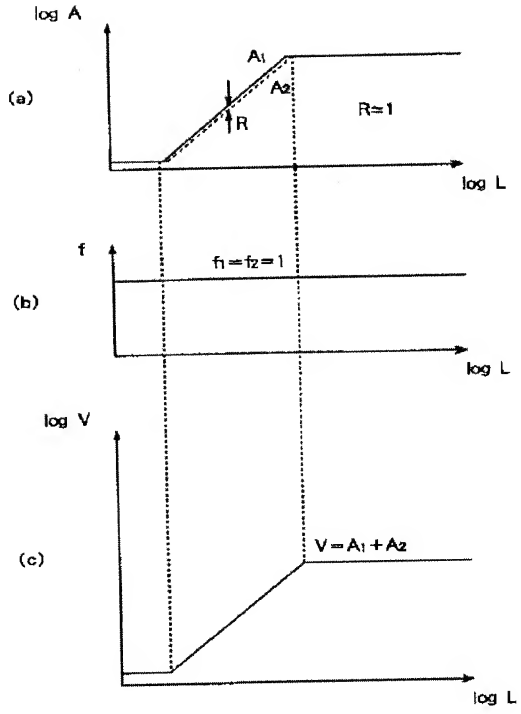
【図３】


log A
(a)
A1
A2
R
log L
f
(b)
f1
f2
(f2=1−f1)
1
0
log L
log V
(c)
V=f1A1 +Rf2A2
log L

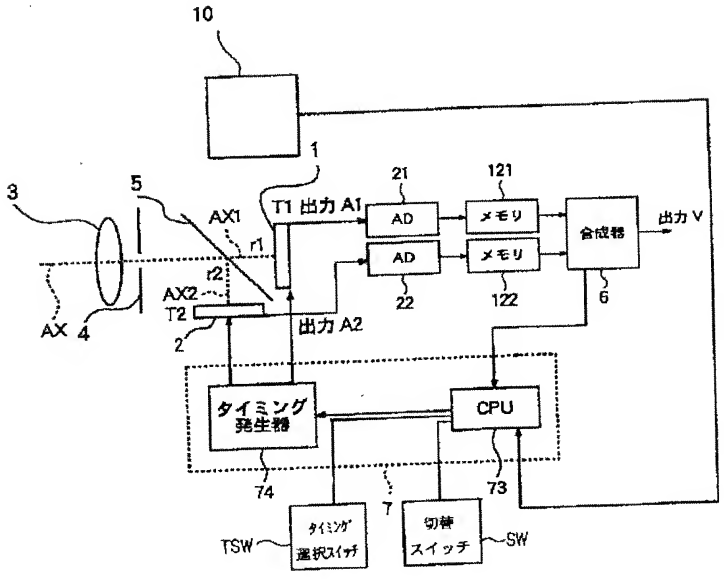
【図４】


log A
A1
(a)
R
A2
log L
f
f1
f2
f2=1−f1
(b)
1
0
log L
log V
(c)
V=f1A1+Rf2A2
log L

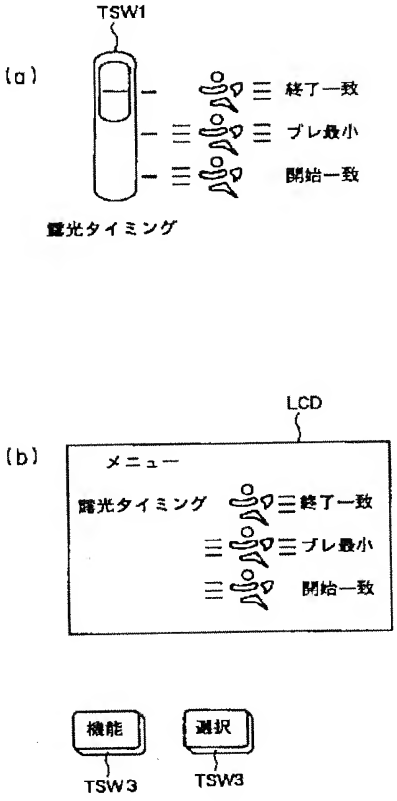
【図５】


log A
A1
A2
(a)
R
R=1
log L
f
f1=f2=1
(b)
log L
log V
(c)
V=A1+A2
log L

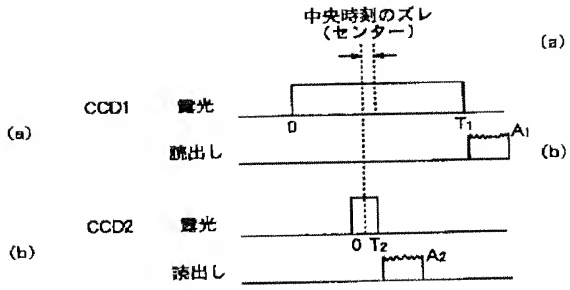
【図６】


10
1
3
5
AX1
T1 出力 A1
21
121
AD
メモリ
合成器
出力 V
f1
AD
メモリ
f2
AX2
T2
22
122
6
AX
4
2
出力 A2
タイミング発生器
CPU
74
7
73
TSW
タイミング選択スイッチ
切替スイッチ
SW

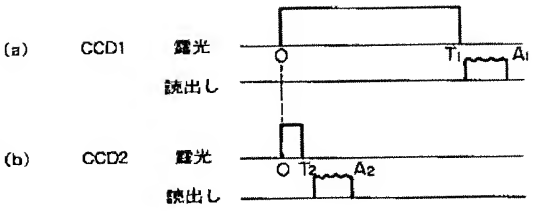
【図７】


TSW1
(a)
終了一致
ブレ最小
開始一致
露光タイミング
LCD
(b)
メニュー
露光タイミング
終了一致
ブレ最小
開始一致
機能
選択
TSW3
TSW3

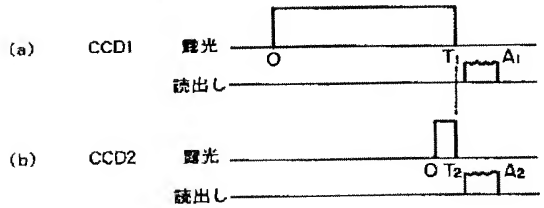
【図８】



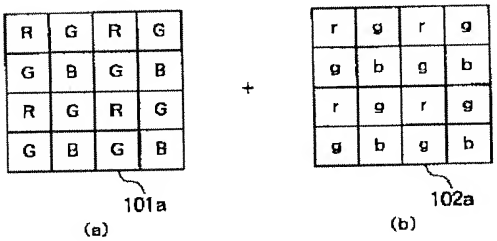

【図９】



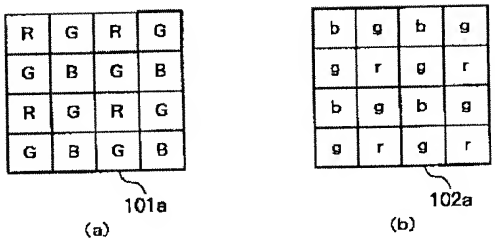

【図１０】



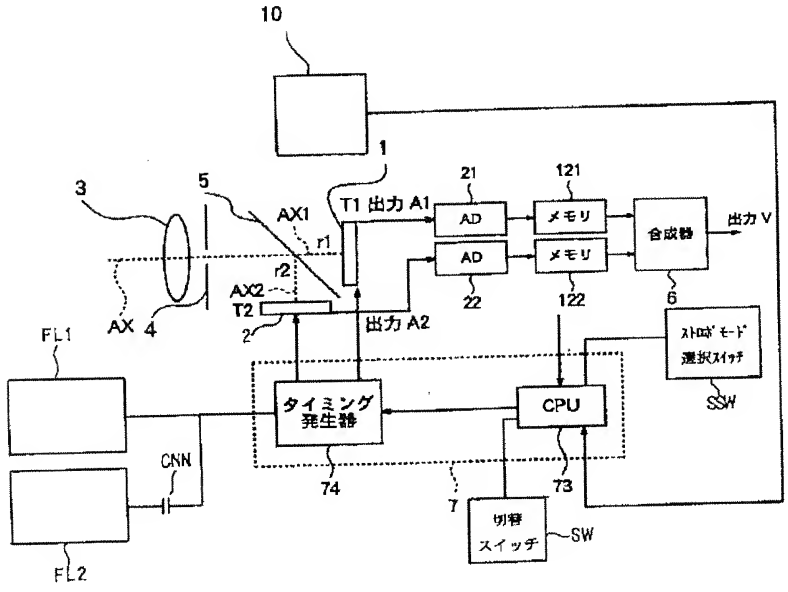

【図１６】



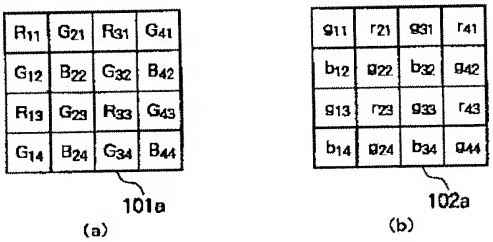

【図１７】



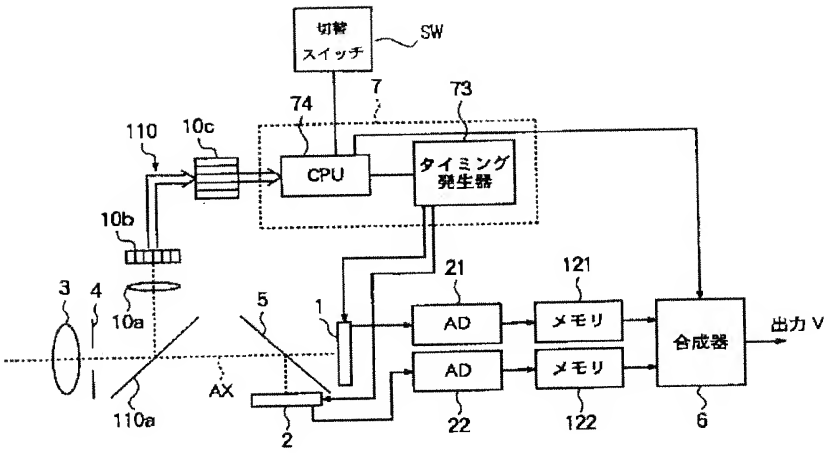

【図１１】



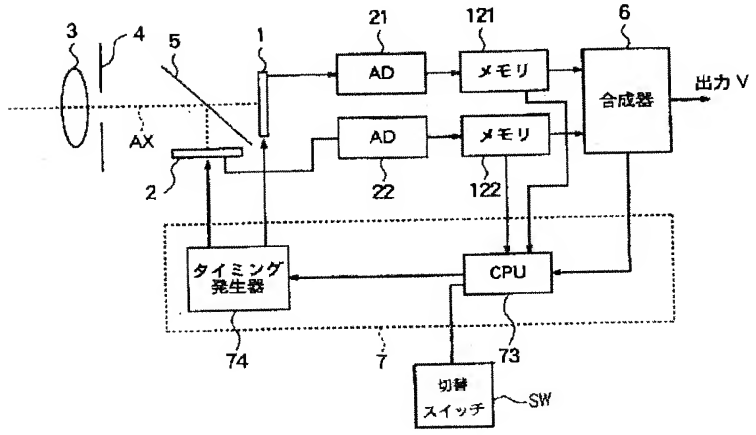

【図１８】



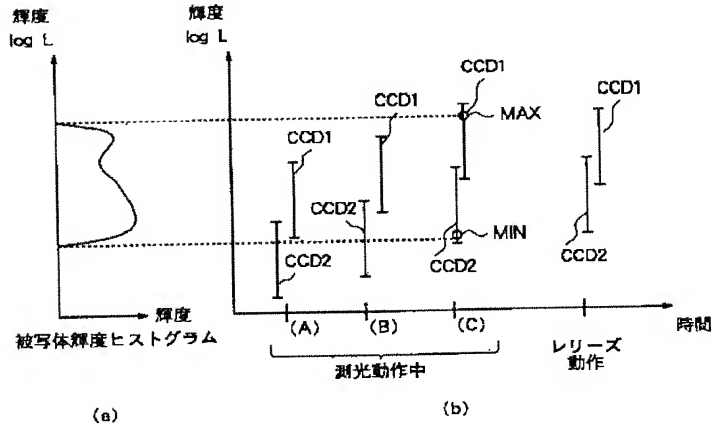
【図１２】



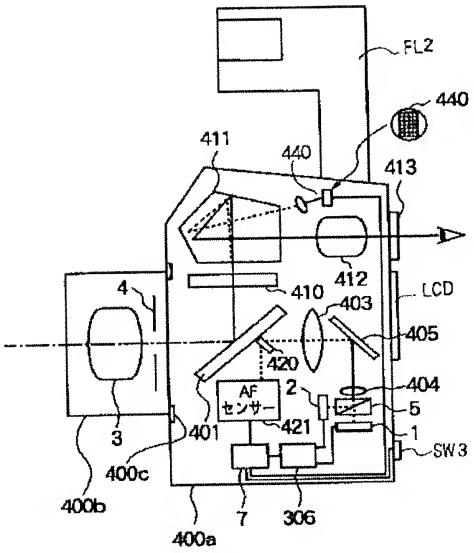

【図１３】



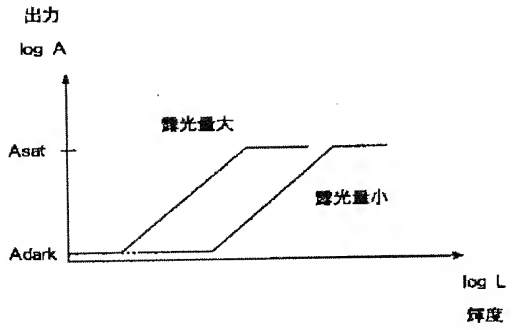

【図１４】



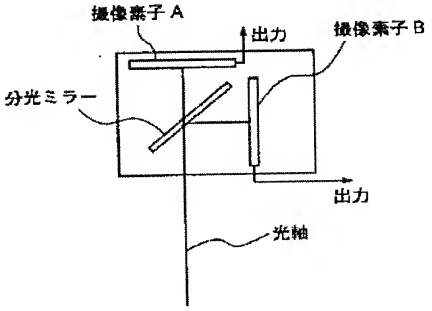

【図２０】



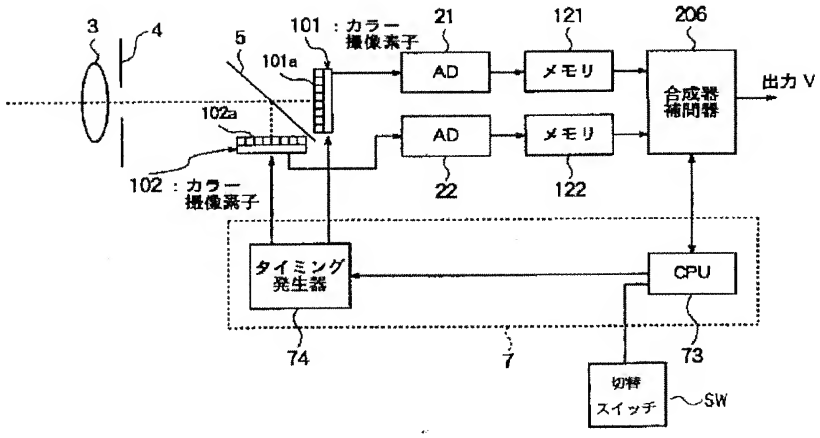

【図２３】



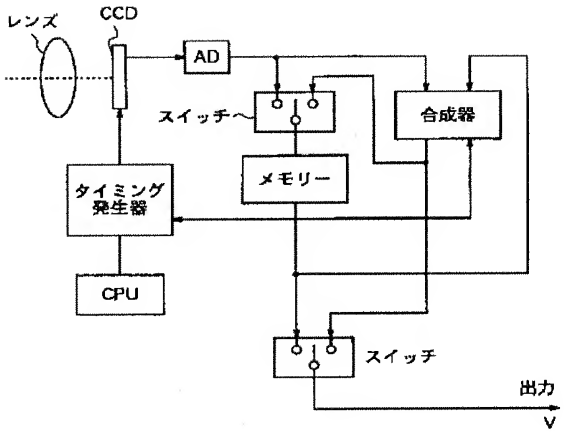

【図２１】



【図１５】


3
4
5
101 ：カラー撮像素子
101a
102a
102 ：カラー撮像素子
21
AD
121
メモリ
206
合成器補間器
出力 V
AD
22
メモリ
122
タイミング発生器
74
CPU
73
7
切替スイッチ
SW

【図２２】


レンズ
CCD
AD
スイッチ
合成器
メモリー
タイミング発生器
CPU
スイッチ
出力
V